DOE Award No.: DE-FE0023919

Quarterly Research Performance Progress Report

(Period Ending 03/31/22)

Deepwater Methane Hydrate Characterization & Scientific Assessment

Project Period 5: 10/01/20 - 09/30/22

Submitted by:

Peter B. Flemings

Signature

The University of Texas at Austin
DUNS #: 170230239
101 East 27th Street, Suite 4.300
Austin, TX 78712-1500
Email: pflemings@jsg.utexas.edu
Phone number: (512) 475-8738

Prepared for:
United States Department of Energy
National Energy Technology Laboratory

May 6, 2022

Office of Fossil Energy

Submitted By:

Peter B. Flemings, Principle Investigator

Jesse Houghton, Senior Project Manager

Carla Thomas, Science/Technical Program Manager

Jamie Morrison, Offshore Project Manager

DISCLAIMER

1 ACCOMPLISHMENTS

This report outlines the progress of the fourth quarter of the seventh fiscal year of the project (Budget Period 5, Year 1). Highlights from this period include:

- **UT-GOM2-2 Vessel Procurement**
  UT executed a final contract with Helix Well Ops. to perform the UT-GOM2-2 drilling program using the Helix Q4000 or Q5000 semisubmersible intervention vessel.

- **UT-GOM2-2 Permit Approvals**
  Three UT-GOM2-2 Expedition permit applications / procedures were completed this quarter:
  1. BOEM approved UT's request to update the BOEM-Authorized Delegate. BOEM has updated UT's qualification and will now recognize Dr. Daniel Jaffe, Vice President for Research, as UT's Authorized Official.
  2. UT accepted and counter-executed the BOEM Right-of-Use and Easement (RUE) in Walker Ridge Block 313 (OCS-G 30392). The RUE is effective as of February, 2022.
  3. UT completed and submitted a NEPA Environmental Questionnaire for UT-GOM2-2. The Environmental Questionnaire was accepted and UT was granted a Categorical Exclusion for UT-GOM2-2.

- **Probe Deployment Tool Bench Test**
  UT conducted a full function bench test of the Probe Deployment Tool (PDT) at Geotek's high-pressure downhole test facility in Salt Lake City, Utah. Multiple successful tests of the modified PDT latch assembly were performed. The bench test demonstrated that recent modifications to improve the sturdiness and reliability the PDT were successful. The PDT is now ready for field deployment.

1.1 Major Project Goals

The primary objective of this project is to gain insight into the nature, formation, occurrence and physical properties of methane hydrate-bearing sediments for the purpose of methane hydrate resource appraisal. This will be accomplished through the planning and execution of a state-of-the-art drilling, coring, logging, testing and analytical program that assess the geologic occurrence, regional context, and characteristics of marine methane hydrate deposits in the Gulf of Mexico Continental Shelf. Project Milestones are listed in Table 1-1, Table 1-2, and Table 1-3.

Table 1-1: Previous Milestones

Budget Period	Milestone	Milestone Description	Estimated Completion	Actual Completion	Verification Method
1	M1A	Project Management Plan	Mar-15	Mar-15	Project Management Plan
	M1B	Project Kick-off Meeting	Jan-15	Dec-14	Presentation
	M1C	Site Location and Ranking Report	Sep-15	Sep-15	Phase 1 Report
	M1D	Preliminary Field Program Operational Plan Report	Sep-15	Sep-15	Phase 1 Report
	M1E	Updated CPP Proposal Submitted	May-15	Oct-15	Phase 1 Report
	M1F	Demonstration of a Viable Pressure Coring Tool: Lab Test	Sep-15	Sep-15	Phase 1 Report
2	M2A	Document Results of BP1/Phase 1 Activities	Dec-15	Jan-16	Phase 1 Report
	M2B	Complete Updated CPP Proposal Submitted	Nov-15	Nov-15	QRPPR
	M2C	Scheduling of Hydrate Drilling Leg by IODP	May-16	May-17	Report directly to DOE PM
	M2D	Demonstration of a Viable Pressure Coring Tool: Land Test	Dec-15	Dec-15	PCTB Land Test Report, in QRPPR
	M2E	Demonstration of a Viable Pressure Coring Tool: Marine Test	Jan-17	May-17	QRPPR
	M2F	Update UT-GOM2-2 Operational Plan	Feb-18	Apr-18	Phase 2 Report
3	M3A	Document results of BP2 Activities	Apr-18	Apr-18	Phase 2 Report
	M3B	Update UT-GOM2-2 Operational Plan	Sep-19	Jan-19	Phase 3 Report
4	M4A	Document results of BP3 Activities	Jan-20	Apr-20	Phase 3 Report
	M4B	Demonstration of a Viable Pressure Coring Tool: Lab Test	Feb-20	Jan-20	PCTB Lab Test Report, in QRPPR
	M4C	Demonstration of a Viable Pressure Coring Tool: Land Test	Mar-20	Mar-20	PCTB Land Test Report, in QRPPR

Table 1-2: Current Milestones

Budget Period	Milestone	Milestone Description	Estimated Completion	Actual Completion	Verification Method
5	M5A	Document Results of BP4 Activities	Dec-20	Mar-21	Phase 4 Report
	M5B	Complete Contracting of UT-GOM2-2 with Drilling Vessel	May-21	Feb-22	QRPPR
	M5C	Complete Project Sample and Data Distribution Plan	Jul-22	Oct-21	Report directly to DOE PM
	M5D	Complete Pre-Expedition Permitting Requirements for UT-GOM2-2	Dec-21	-	QRPPR
	M5E	Complete UT-GOM2-2 Operational Plan Report	May-21	Sep-21	QRPPR
	M5F	Complete UT-GOM2-2 Field Operations	Jul-22	-	QRPPR

Table 1-3: Future Milestones

Budget Period	Milestone	Milestone Description	Estimated Completion	Actual Completion	Verification Method
6	M6A	Document Results of BP5 Activities	Dec-22	-	Phase 5 Report
	M6B	Complete Preliminary Expedition Summary	Dec-22	-	Report directly to DOE PM
	M6C	Initiate comprehensive Scientific Results Volume	Jun-23	-	Report directly to DOE PM
	M6D	Submit set of manuscripts for comprehensive Scientific Results Volume	Sep-24	-	Report directly to DOE PM

1.2 What Was Accomplishments Under These Goals

1.2.1 Previous Project Periods

Tasks accomplished in previous project periods (Phase 1, 2, 3, and 4) are summarized in Table 1-4, Table 1-5, Table 1-6, and Table 1-7.

Table 1-4: Tasks Accomplished in Phase 1

PHASE 1/BUDGET PERIOD 1	
Task 1.0	**Project Management and Planning**
Task 2.0	**Site Analysis and Selection**
Subtask 2.1	*Site Analysis*
Subtask 2.2	*Site Ranking / Recommendation*
Task 3.0	**Develop Operational Plan for UT-GOM2-2 Scientific Drilling Program**
Task 4.0	**Complete IODP Complimentary Project Proposal**
Task 5.0	**Pressure Coring and Core Analysis System Modifications and Testing**
Subtask 5.1	*PCTB Scientific Planning Workshop*
Subtask 5.2	*PCTB Lab Test*
Subtask 5.3	*PCTB Land Test Prep*

Table 1-5: Tasks Accomplished in Phase 2

PHASE 2/BUDGET PERIOD 2	
Task 1.0	**Project Management and Planning**
Task 6.0	**Technical and Operational Support of Complimentary Project Proposal**
Task 7.0	**Continued Pressure Coring and Core Analysis System Modifications and Testing**
Subtask 7.1	*Review and Complete NEPA Requirements for PCTB Land Test*
Subtask 7.2	*PCTB Land Test*
Subtask 7.3	*PCTB Land Test Report*
Subtask 7.4	*PCTB Modification*
Task 8.0	**UT-GOM2-1 Marine Field Test**
Subtask 8.1	*Review and Complete NEPA Requirements for UT-GOM2-1*
Subtask 8.2	*UT-GOM2-1 Operational Plan*
Subtask 8.3	*UT-GOM2-1 Documentation and Permitting*
Subtask 8.4	*UT-GOM2-1 Marine Field Test of Pressure Coring System*
Subtask 8.5	*UT-GOM2-1 Marine Field Test Report*
Task 9.0	**Develop Pressure Core Transport, Storage, and Manipulation Capability**
Subtask 9.1	*Review and Complete NEPA Requirements for Core Storage and Manipulation*
Subtask 9.2	*Hydrate Core Transport*
Subtask 9.3	*Storage of Hydrate Pressure Cores*
Subtask 9.4	*Refrigerated Container for Storage of Hydrate Pressure Cores*

Subtask 9.5	*Hydrate Core Manipulator and Cutter Tool*
Subtask 9.6	*Hydrate Core Effective Stress Chamber*
Subtask 9.7	*Hydrate Core Depressurization Chamber*
Task 10.0	**Core Analysis**
Subtask 10.1	*Routine Core Analysis (UT-GOM2-1)*
Subtask 10.2	*Pressure Core Analysis (UT-GOM2-1)*
Subtask 10.3	*Hydrate Core-Log-Seismic Synthesis (UT-GOM2-1)*
Task 11.0	**Update Science and Operational Plans for UT-GOM2-2 Scientific Drilling Program**
Task 12.0	**UT-GOM2-2 Scientific Drilling Program Vessel Access**

Table 1-6: Tasks Accomplished in Phase 3

PHASE 3/BUDGET PERIOD 3	
Task 1.0	**Project Management and Planning**
Task 6.0	**Technical and Operational Support of CPP Proposal**
Task 9.0	**Develop Pressure Core Transport, Storage, and Manipulation Capability**
Subtask 9.8	*X-ray Computed Tomography*
Subtask 9.9	*Pre-Consolidation System*
Task 10.0	**Core Analysis**
Subtask 10.4	*Continued Pressure Core Analysis (UT-GOM2-1)*
Subtask 10.5	*Continued Hydrate Core-Log-Seismic Synthesis (UT-GOM2-1)*
Subtask 10.6	*Additional Core Analysis Capabilities*
Task 11.0	**Update Science and Operational Plans for UT-GOM2-2 Scientific Drilling Program**
Task 12.0	**UT-GOM2-2 Scientific Drilling Program Vessel Access**
Task 13.0	**Maintenance and Refinement of Pressure Core Transport, Storage, and Manipulation Capability**
Subtask 13.1	*Hydrate Core Manipulator and Cutter Tool*
Subtask 13.2	*Hydrate Core Effective Stress Chamber*
Subtask 13.3	*Hydrate Core Depressurization Chamber*
Subtask 13.4	*Develop Hydrate Core Transport Capability for UT-GOM2-2 Scientific Drilling Program*
Subtask 13.5	*Expansion of Pressure Core Storage Capability for UT-GOM2-2 Scientific Drilling Program*
Subtask 13.6	*Continued Storage of Hydrate Cores from UT-GOM2-1*
Task 14.0	**Performance Assessment, Modifications, and Testing of PCTB**
Subtask 14.1	*PCTB Lab Test*
Subtask 14.2	*PCTB Modifications/Upgrades*
Task 15.0	**UT-GOM2-2 Scientific Drilling Program Preparations**
Subtask 15.1	*Assemble and Contract Pressure Coring Team Leads for UT-GOM2-2 Scientific Drilling Program*
Subtask 15.2	*Contract Project Scientists and Establish Project Science Team for UT-GOM2-2 Scientific Drilling Program*

Table 1-7: Tasks Accomplished in Phase 4

PHASE 4/BUDGET PERIOD 4	
Task 1.0	**Project Management and Planning**
Task 10.0	**Core Analysis**
Subtask 10.4	*Continued Pressure Core Analysis (GOM2-1)*
Subtask 10.5	*Continued Hydrate Core-Log-Seismic Synthesis (UT-GOM2-1)*
Subtask 10.6	*Additional Core Analysis Capabilities*
Subtask 10.7	*Hydrate Modeling*
Task 11.0	**Update Science and Operational Plans for UT-GOM2-2 Scientific Drilling Program**
Task 12.0	**UT-GOM2-2 Scientific Drilling Program Vessel Access**
Task 13.0	**Maintenance and Refinement of Pressure Core Transport, Storage, and Manipulation Capability**
Subtask 13.1	*Hydrate Core Manipulator and Cutter Tool*
Subtask 13.2	*Hydrate Core Effective Stress Chamber*
Subtask 13.3	*Hydrate Core Depressurization Chamber*
Subtask 13.4	*Develop Hydrate Core Transport Capability for UT-GOM2-2 Scientific Drilling Program*
Subtask 13.5	*Expansion of Pressure Core Storage Capability for UT-GOM2-2 Scientific Drilling Program*
Subtask 13.6	*Continued Storage of Hydrate Cores from UT-GOM2-1*
Subtask 13.7	*X-ray Computed Tomography*
Subtask 13.8	*Pre-Consolidation System*
Task 14.0	**Performance Assessment, Modifications, and Testing of PCTB**
Subtask 14.1	*PCTB Lab Test*
Subtask 14.2	*PCTB Modifications/Upgrades*
Subtask 14.3	*PCTB Land Test*
Task 15.0	**UT-GOM2-2 Scientific Drilling Program Preparations**
Subtask 15.3	*Permitting for UT-GOM2-2 Scientific Drilling Program*

1.2.2 Current Project Period

Current project period tasks are shown in Table 1-8.

Table 1-8: Current Project Tasks

PHASE 5/BUDGET PERIOD 5	
Task 1.0	**Project Management and Planning**
Task 10.0	**Core Analysis**
Subtask 10.4	*Continued Pressure Core Analysis (UT-GOM2-1)*
Subtask 10.5	*Continued Hydrate Core-Log-Seismic Synthesis (UT-GOM2-1)*
Subtask 10.6	*Additional Core Analysis Capabilities*
Subtask 10.7	*Hydrate Modeling*
Subtask 10.8	*Routine Core Analysis (UT-GOM2-2)*
Subtask 10.9	*Pressure Core Analysis (UT-GOM2-2)*
Subtask 10.10	*Core-log-seismic Integration (UT-GOM2-2)*
Task 11.0	**Update Science and Operational Plans for UT-GOM2-2 Scientific Drilling Program**
Task 12.0	**UT-GOM2-2 Scientific Drilling Program Vessel Access**
Task 13.0	**Maintenance and Refinement of Pressure Core Transport, Storage, and Manipulation Capability**
Subtask 13.1	*Hydrate Core Manipulator and Cutter tool*
Subtask 13.2	*Hydrate Core Effective Stress Chamber*
Subtask 13.3	*Hydrate Core Depressurization Chamber*
Subtask 13.4	*Develop Hydrate Core Transport Capability for UT-GOM2-2 Scientific Drilling Program*
Subtask 13.5	*Expansion of Pressure Core Storage Capability for UT-GOM2-2 Scientific Drilling Program*
Subtask 13.6	*Continued Maintenance and Storage of Hydrate Pressure Cores from UT-GOM2-1*
Subtask 13.7	*Maintain X-ray CT*
Subtask 13.8	*Maintain Preconsolidation System*
Subtask 13.9	*Transportation of Hydrate Core from UT-GOM2-2 Scientific Drilling Program*
Subtask 13.10	*Storage of Hydrate Cores from UT-GOM2-2 Scientific Drilling Program*
Subtask 13.11	*Hydrate Core Distribution*
Task 14.0	**Performance Assessment, Modifications, and Testing of PCTB**
Subtask 14.4	*PCTB Modifications/Upgrades*
Subtask 14.5	*PCTB Land Test III*
Task 15.0	**UT-GOM2-2 Scientific Drilling Program Preparations**
Subtask 15.3	*Permitting for UT-GOM2-2 Scientific Drilling Program*
Subtask 15.4	*Review and Complete NEPA Requirements*
Subtask 15.5	*Finalize Operational Plan for UT-GOM2-2 Scientific Drilling Program*
Task 16.0	**UT-GOM2-2 Scientific Drilling Program Field Operations**
Subtask 16.1	*Mobilization of a Scientific Ocean Drilling and Pressure Coring Capability*
Subtask 16.2	*Field Project Management, Operations and Research*
Subtask 16.3	*Demobilization of Staff, Labs, and Equipment*

1.2.2.1 Task 1.0 – Project Management & Planning

Status: Ongoing

- **Compared identified risks with those documented in the Project Management Plan to ensure all risks are identified and monitored. Communicated risks and possible outcomes to project team and stakeholders:**
  - UT continued to monitor budget and schedule implications as a result of the delayed UT-GOM2-2 field program and communicate with the DOE project manager.

- **Coordinate the overall scientific progress, administration and finances of the project:**
  - Monitored and controlled project scope, costs, and schedule.

- **Communicate with project team and sponsors:**
  - Organized sponsor and stakeholder meetings.
  - Organized task-specific working meetings to plan and execute project tasks per the Project Management Plan and Statement of Project Objectives.
  - Managed SharePoint sites, email lists, and archive/website.
  - Initiated monthly meetings with the BOEM Regional Analysis Unit to review UT's permit status and identify and resolve issues.

- **Coordinate and supervise service agreements:**
  - UT finalized negotiations and executed a contract with Helix Well Ops. for the UT-GOM2-2 field program. We will perform the UT-GOM2-2 field program using the Helix Q4000 or Q5000 semisubmersible interventional vessel. See Task 12.0 – UT-GOM2-2 Scientific Drilling Program Vessel Access for further information.
  - UT continued contractual discussions with Geotek for UT-GOM2-2 field operations.
  - UT continued to hold recurring technical/science meetings with Geotek to identify and address science and engineering challenges pertaining to UT Pressure Core Center and field science program for the UT-GOM2-2 Scientific Drilling Program.

- **Coordinate subcontractors:**
  - UT continued to monitor and control contractor efforts and scopes of work.

1.2.2.2 Task 10.0 – Core Analysis

Status: Ongoing

1.2.2.2.1 Subtask 10.4 – Continued Pressure Core Analysis (UT-GOM2-1)

A. Pressurized Core Analysis

A1. Strengthening pressure core analyses capabilities

- Geomechanical tests in pressure core samples, unlike traditional geotechnical protocols, experience several limitations (e.g., remote sample manipulation, grit-loaded environment, limited availability to place sensors). UT continues to conduct benchmark studies for the Effective Stress Chamber to identify optimal test protocols and correctly characterize hydrate-bearing sediments.
- During this quarter, we conducted six geomechanical tests using resedimented Boston Blue Clay (RBBC). This material is ideal for comparison studies as its composition can be carefully controlled, and it is well-characterized over a wide range of stresses.
- We performed constant rate of strain tests (CRS) using two test protocols to maintain a uniaxial strain condition (i.e., zero-lateral deformation). The first procedure creates a quasi-rigid confining chamber that hinders radial sample expansion. The second procedure -akin to geotechnical tests- adjusts the confining volume to match the volumetric and axial deformation of the sample.
- Test results and related analyses of the benchmark study are expanded in Subtask 13.2 – Hydrate Core Effective Stress Chamber.

1.2.2.2.2 Subtask 10.6 – Additional Analysis Capabilities

- Oregon State continued to make progress to refine methods for characterizing microbes collected in Gulf of Mexico sediments and distinguishing these microbes from contamination that may occur during sample handling. Strategies for reducing such contamination are also being explored. Oregon State further optimized methods for extracting DNA from low biomass samples including an experiment to determine how to optimize DNA extraction from clays. A number of DNA samples were submitted for sequencing, and this sequencing was underway as the quarter ended.
- University of Washington continued with the development/refinement of analytical methods to quantify trace metal concentrations and ligands in marine sediment pore water, conducting initial tests of the new methods for detection limits, concentration ranges, precision, and accuracy. Based on the results of these initial tests, the method will be refined slightly, and they will begin analyzing samples collected during the GOM2-1 expedition and samples from the New Zealand margin.
- University of New Hampshire continued work on their new *Elementar* CHNS Elemental Analyzer. UNH prepared and ran 30 replicates of a new CHNS lab standard from homogenized marine sediments

collected from the Great Bay Estuary, NH. The are also exploring the use of USGS Denver officer newly developed shale standard materials for additional testing at UNH.

1.2.2.2.3 Subtask 10.7 – Hydrate Modeling

- UT developed a new quantitative model to describe microbial methane generation in coarse-grained marine sediments (sands/silts) during burial. In this model, methanogens live in sand/silt beds and are fed by dissolved organic carbon that is generated in the bounding muds. This new methanogenesis model is integrated into a hydrate simulator we developed (You et al., 2021) which describes the generation, migration, phase partitioning and accumulation of methane as the sediment is deposited from the seafloor and buried through the base of hydrate stability zone.
- We applied the new model to simulate the methane hydrate system at Site U1325 the Cascadia Margin. We found that 1) the transport of DOC from muds to the interbedded silts is dominated by diffusion (Figure 1-1a) ; 2) Transport of DOC from the bounding muds quickly increases DOC concentration in silts from seawater value of 0.1 mM to 5.95 mM at ~4 mbsf, 99% of the DOC concentration in the bounding mud layers Figure 1-1b); 3) Methanogenesis rate decreases rapidly with depth due to the decreasing reactivity of DOC (Figure 1-1c); 4) predicted methane hydrate saturation and distribution matches with field observations very well (Figure 1-1d).

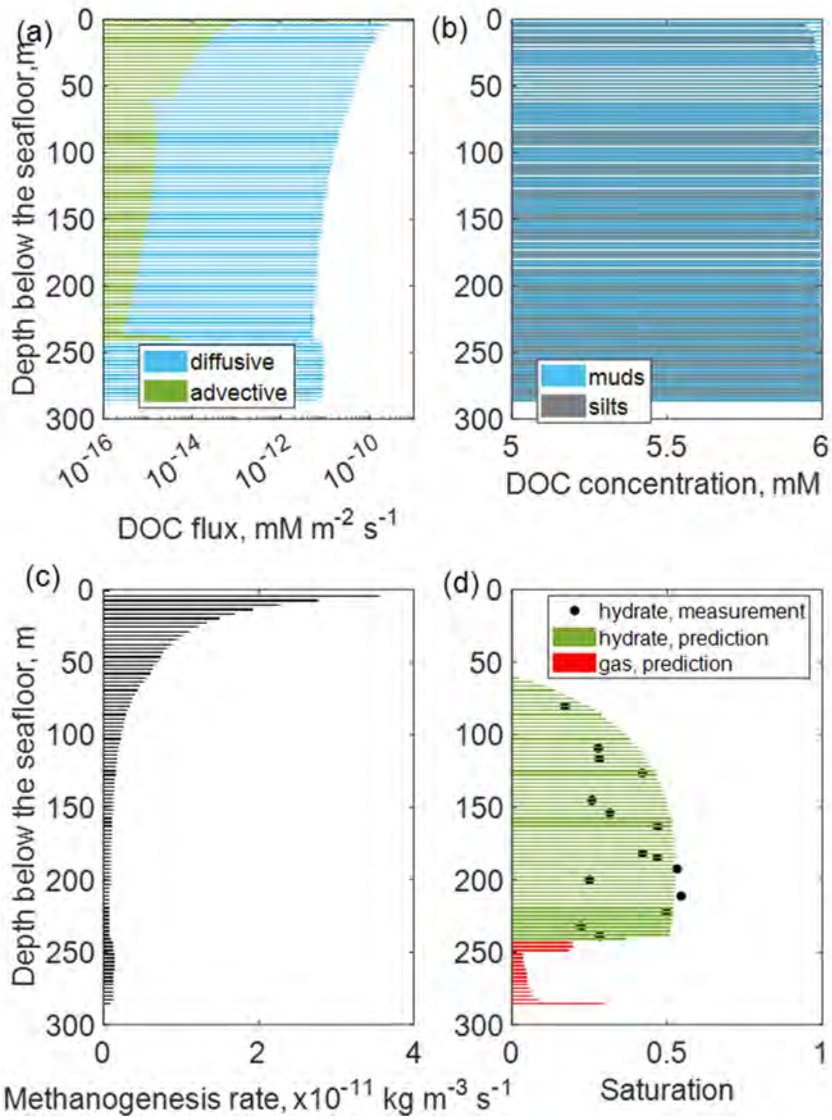

Figure 1-1: Simulated (a) diffusive (blue) and advective (green) DOC flux into each silty layer at 1.5 myr; (b) DOC concentration in muddy (blue) and silty layers (gray); (c) methanogenesis rate in each silty layer; (d) predicted hydrate (green bars) and free gas saturation (red bars). The black dots are interpreted hydrate saturation in silty layers based on measured salinity and well log data (Malinverno et al., 2008).

1.2.2.2.4 Subtask 10.8 – Routine Core Analysis (UT-GOM2-2)

- Future Task.

1.2.2.2.5 Subtask 10.9 – Pressure Core Analysis (UT-GOM2-2)

- Future Task.

1.2.2.2.6 Subtask 10.10 – Core-log-seismic Integration (UT-GOM2-2)

- No Updates.

1.2.2.2.7 Other – Publication and Presentation Work

- AAPG Editors continued working on the AAPG Bulletin GC 955 dedicated Volume 2 and volume introduction.
- GOM2 participants continued working on their AAPG Vol 2 submissions. Table 1-9 shows the current status.

Table 1-9: AAPG Vol 2 submissions

Primary Author	Working Title	Status
Flemings, Cook	Volume Introduction	Ahead of Print
Oti	Using X-ray Computed Tomography (XCT) to Estimate Hydrate Saturation in Sediment Cores from Green Canyon 955, northern Gulf of Mexico	Ahead of Print
Moore	Integrated geochemical approach to determine the source of methane in gas hydrate from Green Canyon Block 955 in the Gulf of Mexico	Ahead of Print
Daigle	Pore structure of sediments from Green Canyon 955 determined by mercury intrusion	Ahead of Print
Wei	Methane migration mechanisms for the Green Canyon Block 955 gas hydrate reservoir, northern Gulf of Mexico	Ahead of Print
Santra	Occurrence of High-Saturation Gas Hydrate in a Fault-Compartmentalized Anticline and the Role of Seal- Green Canyon, Abyssal Gulf of Mexico	Ahead of Print
Yoneda	Comprehensive pressure core analysis for hydrate-bearing sediments from Gulf of Mexico Green Canyon Block 955, including assessments of geomechanical viscous behavior and NMR permeability	Ahead of Print
Fang	Permeability of methane hydrate-bearing sandy silts in the deepwater Gulf of Mexico (Green Canyon block 955)	Ahead of Print
Fang	Compression behavior of hydrate-bearing sediments	Ahead of Print
Phillips	Thermodynamic insights into the production of methane hydrate reservoirs from depressurization of pressure cores	Ahead of Print

1.2.2.3 Task 11.0 – Update Science and Operations Plans for UT-GOM2-2 Scientific Drilling Program

Status: Complete (Milestones 5C, 5E)

1.2.2.4 Task 12.0 – UT-GOM2-2 Scientific Drilling Program Vessel Access

Status: Complete (Milestone 5B)

- UT executed a contract with Helix Well Ops. to perform the UT-GOM2-2 drilling program with the Q4000 or Q5000 semisubmersible intervention vessel. Helix Well Ops. was selected by UT on the basis of a *best value determination*. The best value determination, the contract terms and conditions, and the contract schedules were evaluated and approved by all required UT entities, including the UT Business Contracts, UT Legal Services, UT Purchasing, the office of the President, and the office of the Vice President for Research.
- Helix is now requesting quotes from the various third-party offshore subcontractors for a 2023 expedition. UT is providing specification guidance to Helix regarding required services, materials, equipment, and personnel.

1.2.2.5 Task 13.0 – Maintenance & Refinement of Pressure Core Transport, Storage, & Manipulation Capability

Status: Ongoing

- UT continues to make progress on understanding the mechanisms and extent of core degradation during high pressure storage in fresh water. Work continues on extracting samples of storage fluid from high pressure chambers. The method of storage fluid extraction was refined. New samples were extracted from the top and bottom of two pressure chambers, analyzed for salinity and dissolved methane concentration as shown in Table 1-10. Results were compared to the initial storage fluid condition (0 ppt salinity and 0 mol/kg of methane), pore water salinity (estimated by quantitative degassing to be equivalent to seawater at 3 ppt), and methane saturation (7.50×10^{-2} mol/kg). Results confirm that the storage fluid has not reached equilibrium (storage fluid is still not saturated with methane), meaning that the cores are still degrading but degrading very slowly (over many years).

Table 1-10. Measured salinity and dissolved methane concentration of newly extracted storage fluid samples.

Sample	Starting Pressure (MPa)	Ending Pressure (MPa)	Pressure Drop (MPa)	Gas Collected (ml)	Fluid Mass (g)	Measured Salinity (ppt)	Measured Dissolved Methane Conc. (mol/kg)
5FB-2 Top	26.5	22.0	4.5	4.3	7	0	2.54×10^{-2}
5FB-2 Bottom	22.0	17.5	4.5	8.5	7.16	2	4.90×10^{-2}
8FB-2 Top	23.0	19.5	3.5	3.2	7.35	0	1.80×10^{-2}
8FB-2 Bottom	19.5	16.5	3	5.8	6.92	2	3.45×10^{-2}

- Previous simulations of core degradation have modeled a change in storage fluid salinity and dissolved methane concentration as a function of time and space (see Y7Q1 (Flemings, 2021a) or Y7Q2 (Flemings, 2021b)). These modeled changes are a result of salt diffusion and advection from the pore space into the fresh storage fluid, and loss of hydrate in the pore space of the exposed surfaces of the core. Modeling of the dissolved methane concentration and salt diffusion and advection expected after 15 months predicted dissolved methane concentrations around 5 x 10^{-2} mol/kg with low salinity at the top of the chamber and dissolved methane concentrations close to saturation with higher salinity at the bottom of the chamber. Measurements of the new sample are consistent with the model and further confirm our interpretation of the degradation mechanism being the loss of hydrate as methane is pulled into the fresh storage fluid, and that the degradation mechanism is slow and still occurring.
- The majority of the equipment to allow UT to create and exchange methane-charged water was delivered to UT. The pressure vessel is delayed to due manufacturing delays and material backlogs. The vessel should ship in Q3, 2022.

1.2.2.5.1 Subtask 13.1 – Hydrate Core Manipulator and Cutter Tool

- The mini-PCATS system underwent a saw maintenance teardown. Seals and bearings were replaced and mini-PCATS sediment traps were cleaned.
- The X-ray system underwent quarterly calibration.

1.2.2.5.2 Subtask 13.2 – Hydrate Core Effective Stress Chamber

- We continued to improve our approach conducting uniaxial strain tests. We performed systematic benchmark studies to determine the optimal test protocol.
- The first approach allows no-flow in the confining cell to create a quasi-incompressible chamber and use the confining pressure as a proxy for total lateral stress. However, equipment compressibility (i.e., compressibility of the water and the cell itself) needs to be continuously corrected to ensure uniaxial strain conditions.
- The second approach adjusts the confining cell volume such that the sample volume change $\Delta V_{uniaxial} = A_{sample}*\Delta L$ under uniaxial conditions is equal to the expelled pore volume ΔV_{pore}. However, this mode requires seamless data integration between the pumps and the Geotek software. UT and Geotek implemented data stream protocols that allow communication between both software.
- Figure 1-2 shows a comparison between measurements conducted in the Effective Stress Chamber and a benchmark dataset using resedimented Boston Blue Clay (RBBC). We use this material to have repeatable specimens with well-characterized properties. Void ratio e vs. effective axial stress σ'_a trends overlap in most cases with respect to the benchmark dataset, except for RBBC-4 (Figure 1-2a). Similarly, the confining to axial effective stress ratio $K_0 = \sigma'_c / \sigma'_a$ data shows good agreement between the two sets (Figure 1-2b). Post-test inspection of the RBBC-4 test indicates significant lateral expansion. This

observation explains the differences in void ratio and confining to axial effective stress ratio data. This issue was subsequently resolved.

- The RBBC-9 test was conducted using the second approach to run uniaxial strain tests. While there is no significant advantage to using this mode, UT will conduct more tests to elucidate the optimal test protocol and accurately run tests in hydrate-bearing samples.

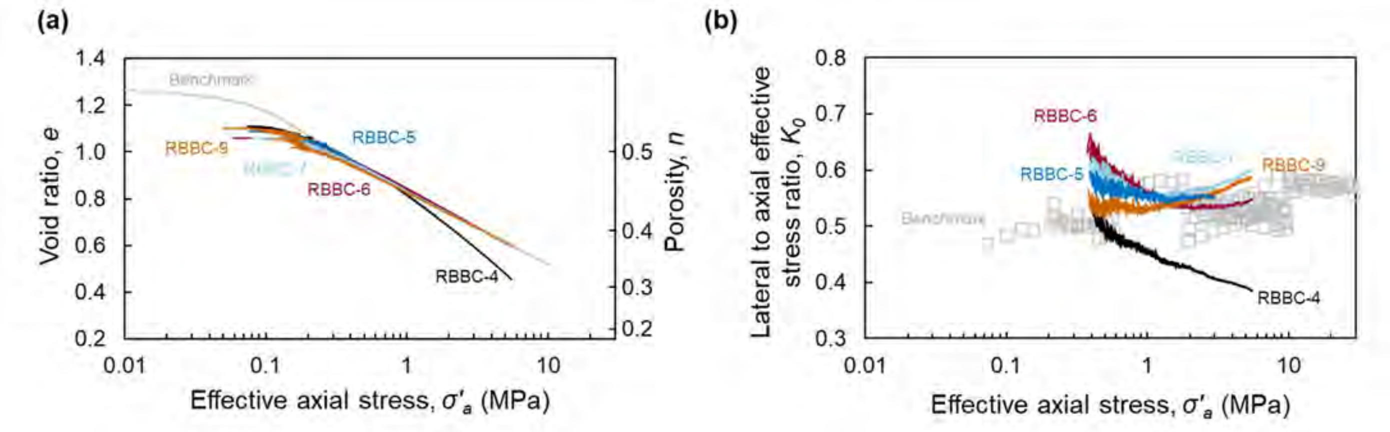

Figure 1-2: Resedimented Boston Blue Clay (RBBC) (a) compression and (b) lateral to axial effective stress ratio data for samples RBBC-4 to RBBC-9. Post-test inspection of sample RBBC-4 indicates significant radial expansion.

1.2.2.5.3 Subtask 13.3 – Hydrate Core Depressurization Chamber

- The system underwent maintenance and cleaning.

1.2.2.5.4 Subtask 13.4 – Develop Hydrate Core Transport Capability for UT-GOM2-2

- No update this period.

1.2.2.5.5 Subtask 13.5 – Expansion of Pressure Core Storage Capability for UT-GOM2-2

- UT obtained a new core chamber orientation support base. After obtaining and evaluating a single example of the design, UT has determined that the base needs to be enlarged slightly to ensure proper access to pressure chamber valves and pressure relief lines. A refined design will be produced and sent out for updated quotes. continues to evaluate the quad base design for long-term feasibility in terms of pressure maintenance access and pressure relief.
- Expansion of pressure maintenance system is required to increase storage capability sufficient to receive UT-GOM2-2 cores. UT has obtained a finalized quote for additional pressure maintenance manifolds. Expansion of pressure safety venting system will also be required. UT has obtained a finalized quote for additional venting lines. UT continues to evaluate how to streamline the expansion of the pressure maintenance system and venting system.
- Evaluation and maintenance testing of methane monitoring system and possible expansion being explored.

1.2.2.5.6 Subtask 13.6 – Continued Storage of Hydrate Cores from UT-GOM2-1

- Core storage expansion in the PCC is anticipated to accommodate any remaining pressure cores acquired from UT-GOM2-1, even when additional cores are collected during UT-GOM2-2 and transferred to the PCC.

1.2.2.5.7 Subtask 13.7 – X-ray Computed Tomography

- The X-Ray CT continues to operate as designed.
- During this period, the system was calibrated.
- The Dell Image Reconstruction computer was found to have a faulty motherboard/memory interaction in the previous quarter and it was repaired under Dell warranty. The computer is now operating normally

1.2.2.5.8 Subtask 13.8 – Pre-Consolidation System

- Geotek made a service visit during the quarter for inspection and repair of the Pre-Consolidation system bladder that was determined to be leaking in the previous quarter.
- The hydraulic accumulator bladder that was replaced and leak-tested appears to be holding nitrogen well, indicating long-term pressure stability for sample storage. A long-term dummy sample test will be run in the future with an Effective Stress Chamber Test Section to ensure that each hydraulic accumulator can provide a different pressure to ensure proper axial loading of a sample in long-term storage.

1.2.2.5.9 Subtask 13.9 – Transportation of Hydrate Core from UT-GOM2-2 Scientific Drilling Program

Future Task.

1.2.2.5.10 Subtask 13.10 – Storage of Hydrate Cores from UT-GOM2-2 Scientific Drilling Program

Future Task.

1.2.2.5.11 Subtask 13.11 – Hydrate Core Distribution

Future Task.

1.2.2.6 Task 14.0 – Performance Assessment, Modifications, And Testing of PCTB

Status: Complete

1.2.2.6.1 Subtask 14.4 – PCTB Modifications/Upgrades

Status: Complete

1.2.2.6.2 Subtask 14.5 – PCTB Land Test III

Status: Complete

1.2.2.7 Task 15.0 – UT-GOM2-2 Scientific Drilling Program Preparations

Status: In Progress

1.2.2.7.1 Continued Development of WR 313 Geology & Geohazards

- UT performed detailed seismic- and log-based analysis of the stratigraphic interval containing the Green and Orange sands in the Walker Ridge 313 basin. The Orange and Green sands in Walker Ridge Block 313 are hydrate-bearing reservoirs located in the Terrebonne mini-basin in the deepwater Gulf of Mexico. The analysis of the evolution of this system is illustrated in Figure 1-3. In the lower (Green) interval, a channel system prograded and aggraded to the mini-basin margin and thereafter incision occurred. The Green sand is a channel sand deposited within the channel on top of the underlying erosive surface. The channel is oriented NW-SE and flowed towards the SE where salt-related uplift took place. In the overlying (Orange) interval, the leveed-channel system is still present and it continues to aggrade. However, the Orange interval is capped by a blocky sand (the Orange sand) that records regional deposition of a sheet sand that is unrelated to the channel itself. After deposition of the Orange sand, the channel incised and reworked the Orange sand as it continued to aggrade. The WR 313 H well penetrated the levee deposits on the northeast flank of the channel. The GR log and Resistivity logs from the H well record two coarsening upward signatures several feet apart which are interpreted as the Green sand and the Orange sand. The WR 225 001 well records a coarsening-upward GR signature that confirms the presence of the Orange sand towards the north, into the broader Terrebonne mini-basin, and further away from the channel.

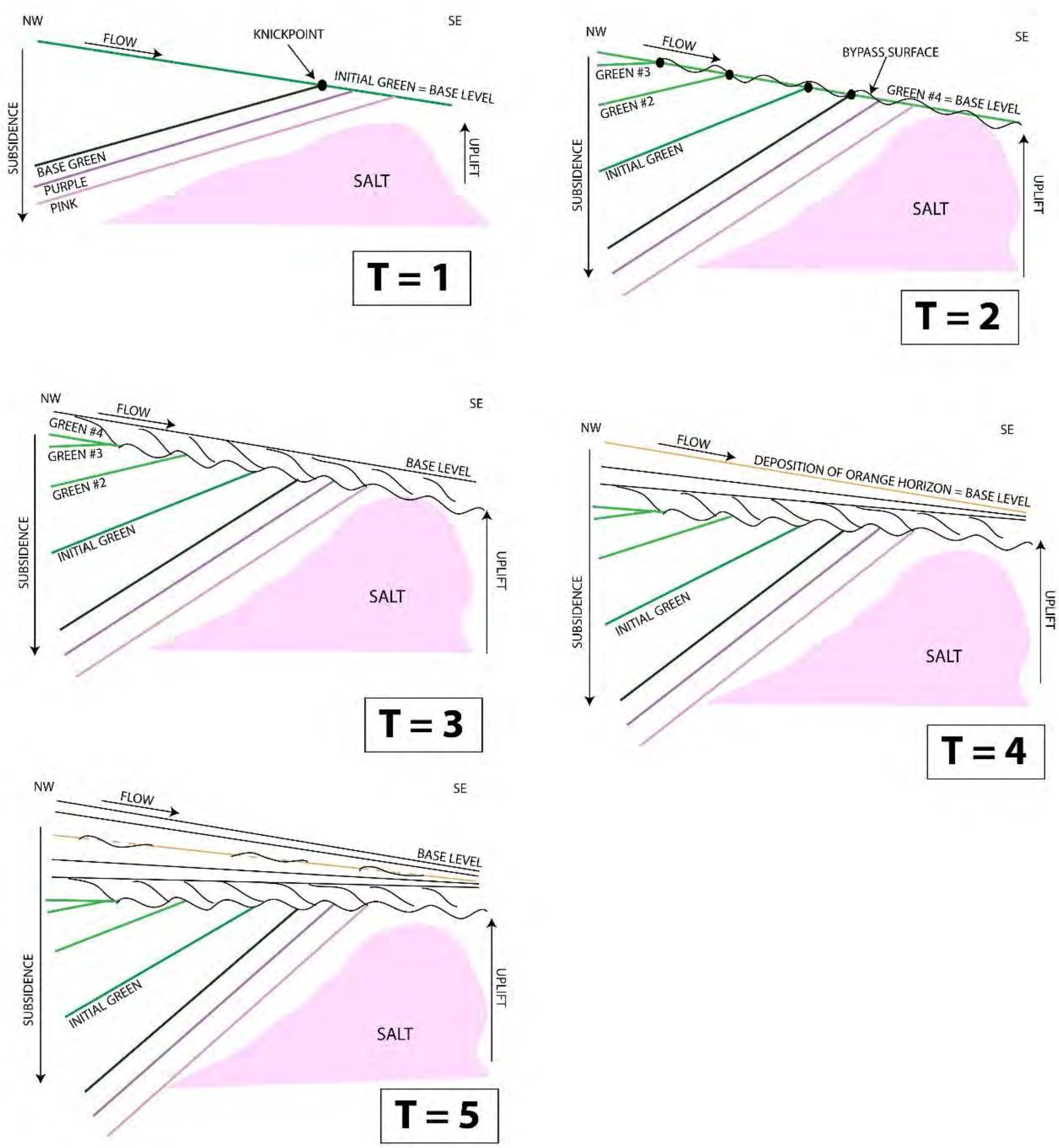

Figure 1-3: Interpreted 2D evolution of the submarine channel system in WR 313. At T = 1, the Green Horizon was deposited. Subsidence occur upstream and uplift occurs downstream. At T = 2, the channel aggrades on the NW (upstream) side and incises on the SE (downstream) side. A knickpoint develops and propagates upstream. Downstream from the knickpoint, sediment bypasses and there is no channelized deposition. At T = 3, aggradation begins with channel deposition beginning upstream and propagating downstream. At T = 4, the channel aggrades at an equilibrium depth profile. The Orange sand is a regionally sheet sand deposited across the Terrebonne basin. At T = 5, the channel incises the Orange sand and continues to aggrade until it eventually shuts off.

- UT is performing palinspastic restoration of the Terrebonne basin, within which the WR313 hydrate-bearing sands exist, using 2D- and 3D seismic data, and well log data. The intention is to use this restoration to drive a forward model to describe the evolution of pressure and temperature and determine the depth of the base of hydrate stability using the software Petromod. The study area has been extended north far beyond the WR313 block (where the drilling is planned) and covers the entire Terrebonne basin (Figure 1-4).

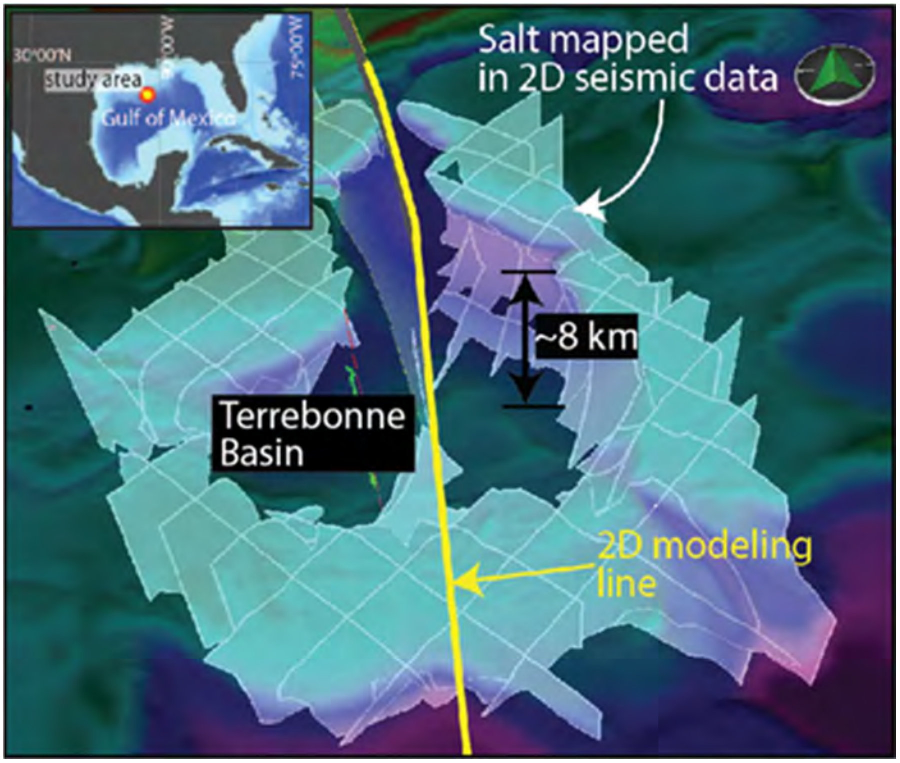

Figure 1-4: Salt surface interpreted in the 2D seismic data. Location of the Terrebonne Basin is indicated in the inset.

- UT has also performed 1D hydromechanical and geothermal numerical modeling to better understand the pressure and temperature distribution under the high sedimentation rates inferred for the Terrebonne basin. Initial results show very low sediment temperature and elevated pore pressure in the central segment of the basin resulting in dramatic downward expansion of the gas hydrate stability zone (Figure 1-5). UT will perform 2D basin modeling along several transects based on restored salt movement in the Plio-Pleistocene period. This will provide better insights into the volume and extent of the gas hydrate stability zone in the Terrebonne and similar basins with the rapid sedimentation rates. One publication and an oral talk at AAPG/SEG Image conference next fall are anticipated.

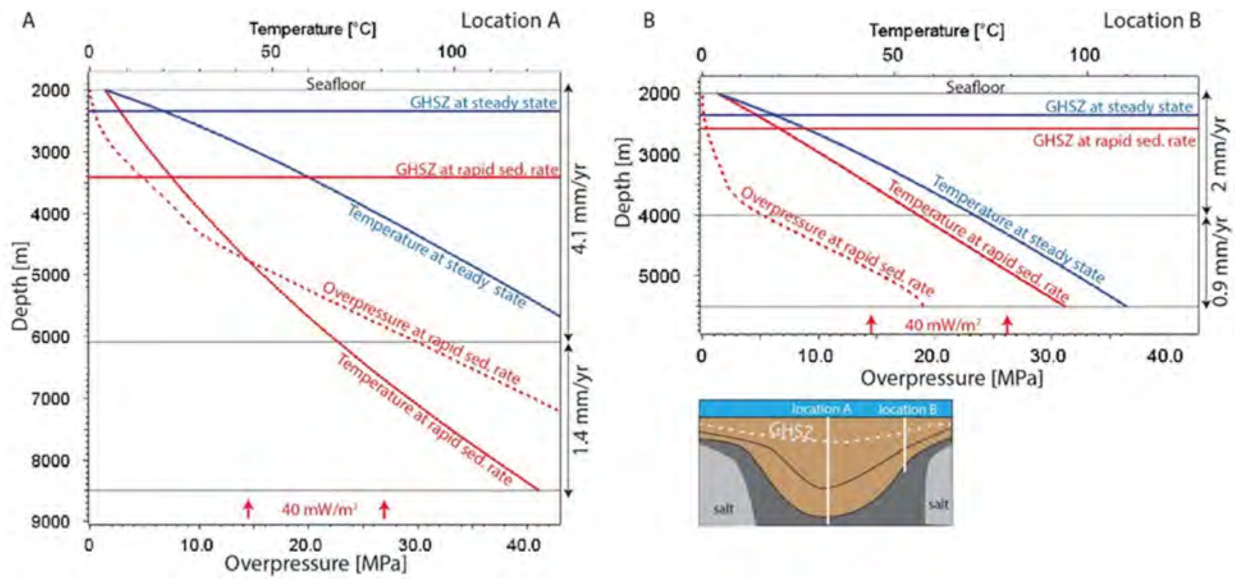

Figure 1-5: One-dimensional pressure and temperature modeling at steady-state (blue lines) and rapid sedimentation rates (red lines) calculated for the Terrebonne Basin, Gulf of Mexico. (A) Location A is in the central part of the basin with the highest sedimentation rates that reach 4.1 mm/yr. (B) Location B is at the basin margin with sedimentation rates reaching 2 mm/yr. Our results show that low sediment temperatures (red solid curves) coupled with the high pore pressure (red dashed curves) drive anomalously deep GHSZ reaching ~1500 mbsf in the central part of the Terrebonne Basin.

- Ohio State conducted a study estimating the P-wave Velocity of WR313 near-seafloor sediments using machine learning. P-wave velocity (V_p) is an essential measurement in shallow marine sediments that is used for characterizing natural gas hydrate, understanding shallow natural hazards, and tying well data to seismic data. They predicted highly accurate V_p in sediments in the gas hydrate stability zone using a machine learning approach where we tested five different machine learning algorithms. The results can be used in intervals or locations where data is unavailable or poor quality. They used scientific quality logging-while-drilling (LWD) data from 22 holes from the Gulf of Mexico, the Cascadia Margin, and the Bay of Bengal and found that the Random Forest algorithm has the best R^2 values and the lowest mean absolute percentage error (MAPE) for V_p prediction followed by the Polynomial Regression algorithm. The statistical values for Holes Walker Ridge Hole WR313-G and WR313-H are shown in Table 1-11 and log plots are shown in Figure 1-6 and Figure 1-7. They have further broken out the results for three different types of intervals: 1) water saturated (white) 2) hydrate in the primary pore space (blue) and 3) hydrate in near vertical fractures (yellow) (Figure 1-6 and Figure 1-7). As shown in Table 1-11, V_p in water saturated intervals and hydrate in the primary pore space can be predicted quite accurately using a Random Forest algorithm and gamma ray, bulk density and ring resistivity logs. When hydrate occurs in near vertical fractures, it is more difficult to predict V_p accurately, which is likely due to the electrical anisotropy caused by variable fracture orientations and fracture planes
- Columbia University continued working on reaction-transport modeling of microbial methanogenesis. The focus is on developing an improved model of how microbes, which may be present only in discrete depth intervals, break down solid organic matter and eventually produce methane. The goal of this work is to assist in the interpretation of the geochemical and microbiological measurements that will be collected in the GOM2-2 drilling expedition.

Table 1-11: Statistical analysis for V_p prediction averaged over Holes WR313-G and WR313-H for water-saturated sediments, gas hydrate in near vertical fractures and gas hydrates in the primary pore space. (MAPE = mean absolute percentage error)

		Depth (mbsf)		**Random Forest**		**Polynomial Regression**	
		WR313-G	**WR313-H**	**R^2**	**MAPE**	**R^2**	**MAPE**
V_p Case 1 (Input logs: Gamma Ray, Bulk Density, Ring Resistivity)	Complete log interval	31-1043	29-1000	0.70	3.9%	0.66	3.5%
	Water Saturated	107-233; 423-598; 605-822; 934-1043	29-155; 335-598; 721-804; 822-944	0.80	2.9%	0.83	2.8%
	Hydrate in Fractures	<27-106; 235-403	160-292; 294-316; 440-611	0.41	5.5%	0.67	2.9%
	Hydrate in Pores	236-237; 601-605; 622-624; 650-653; 830-839; 844-847; 854-872	292-294; 619-621; 664-666; 679-680; 805-818	0.82	6.5%	0.34	11%
V_p Case 2 (Input logs: Gamma Ray, Bulk Density, Propagation Resistivity)	Complete log interval	31-1043	29-1000	0.63	4.9%	0.32	8.4%
	Water Saturated	107-233; 423-598; 605-822; 934-1043	29-155; 335-598; 721-804; 822-944	0.62	4.8%	0.60	4.8%
	Hydrate in Fractures	<27-106; 235-403	160-292; 294-316; 440-611	0.65	2.6%	0.51	5.7%
	Hydrate in Pores	236-237; 601-605; 622-624; 650-653; 694-695; 830-839; 844-847; 854-872	292-294; 619-621; 664-666; 679-680; 805-818	0.68	14%	0.01	25%

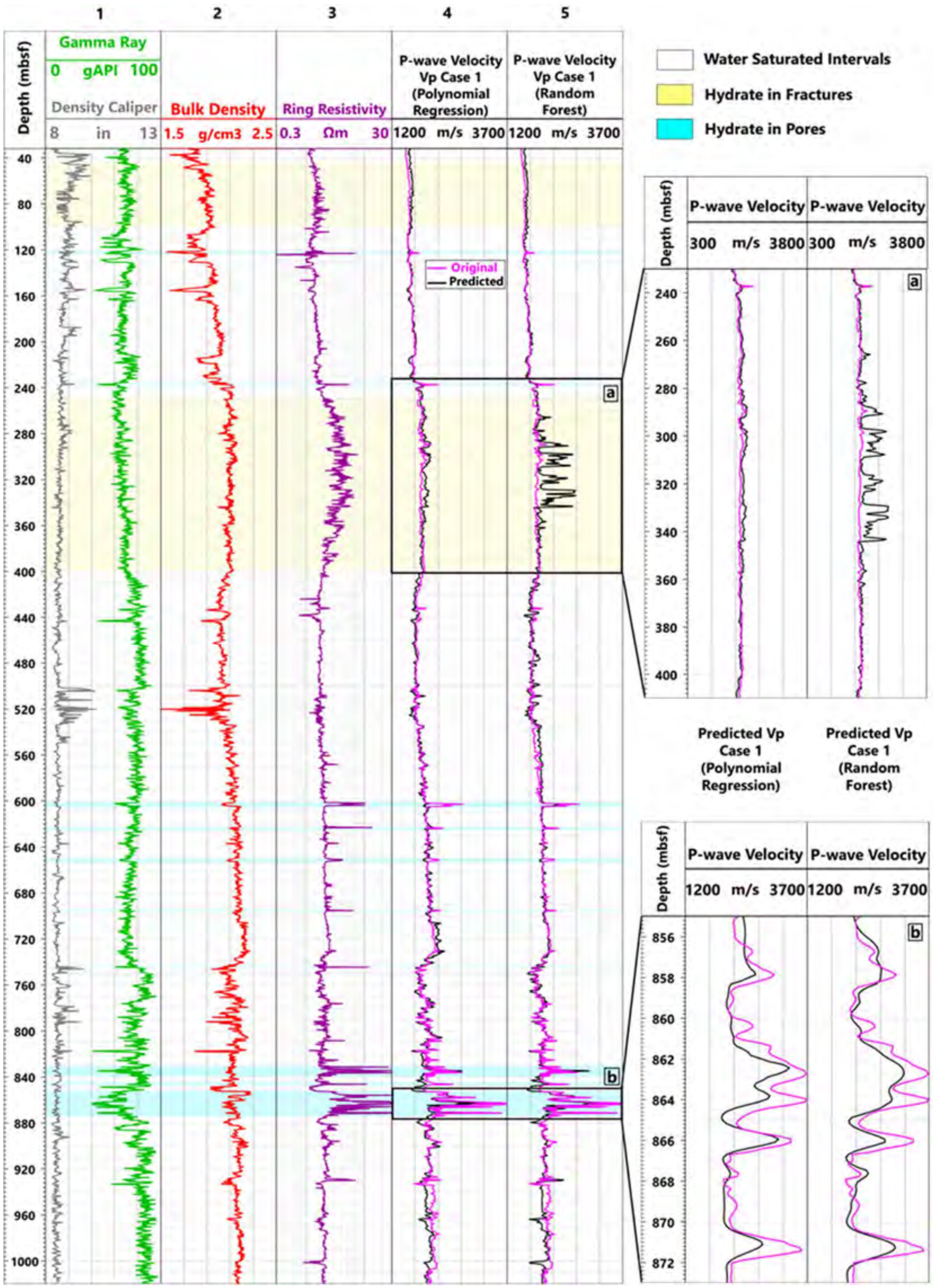

Figure 1-6: LWD data from 31 – 1043 mbsf (m below sea floor) in Hole WR313-G showing the results from Polynomial Regression (Track 5) and Random Forest (Track 6) for V_p Case1. Insets show (a) interval with hydrates in fractures and (b) interval with hydrate in pore space.

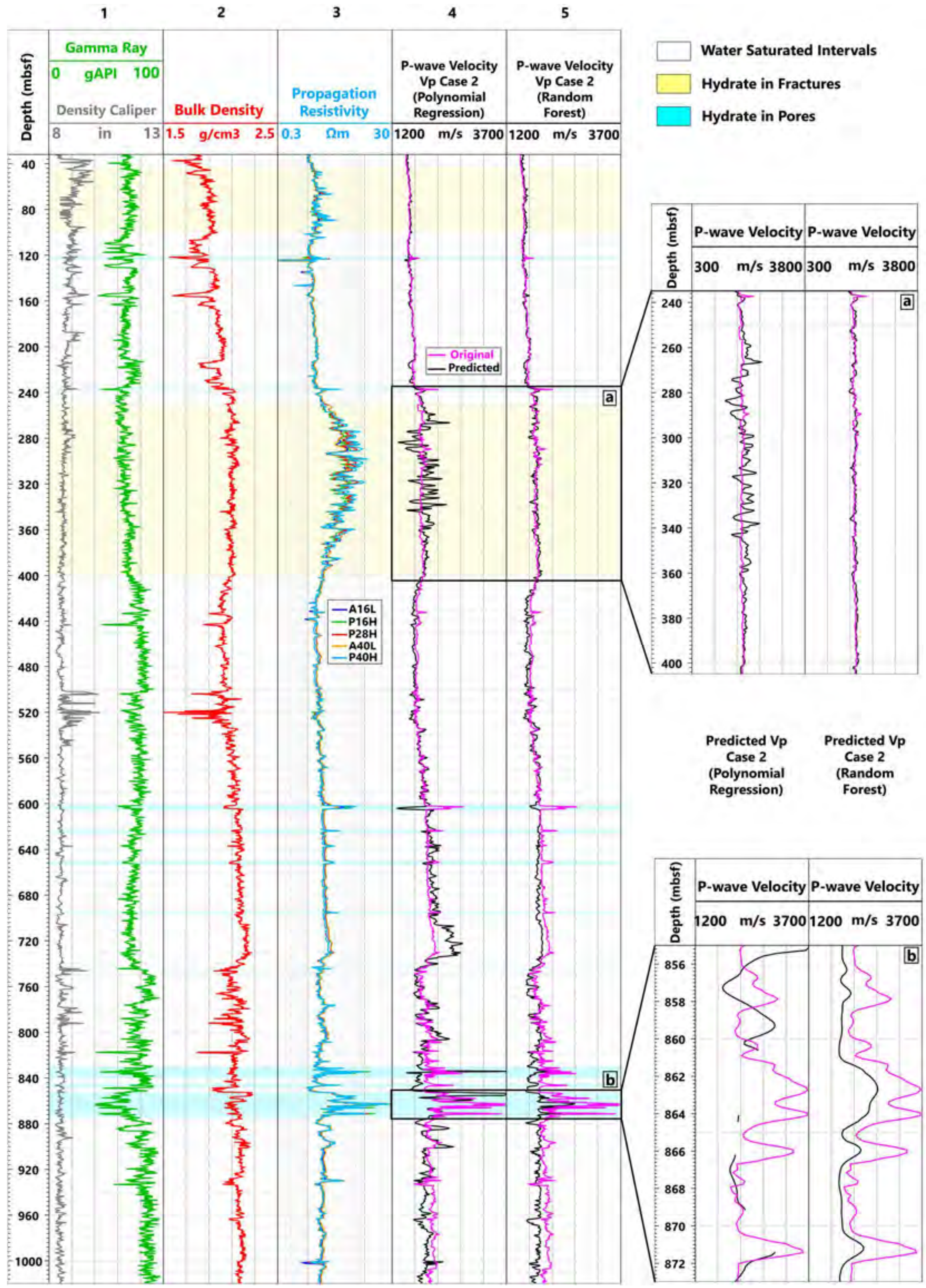

Figure 1-7: LWD data from Hole WR313-G and the results for Polynomial Regression (Track 5) and Random Forest (Track 6) for V_p Case 2. The insets show (a) interval with hydrate in fractures and (b) interval with hydrate in the pore space.

1.2.2.7.2 Subtask 15.3 – Permitting for UT-GOM2-2 Scientific Drilling Program

- On Jan. 10, BOEM Adjudication Section approved UT's request for a change in Name and Title for UT's Authorized Official from Dr. Alison Preston, Interim Vice President for Research to Dr. Daniel Jaffe, Vice President for Research. BOEM now recognizes Dr. Daniel Jaffe, Vice President for Research, as UT's Authorized Official to the Federal Government.
- On Feb. 11, UT's BOEM-Authorized Delegate, Dr. Daniel Jaffe, Vice President for Research, accepted and counter-executed the BOEM Right-of-Use and Easement (RUE) for Walker Ridge Block 313 (OCS-G 30392). The RUE is effective as of the date of Dr. Jaffe's acceptance and signature on Feb. 11.
- UT and BOEM Regional Analysis Unit initiated monthly meetings to review UT's permit status and identify and resolve issues. UT is deferring submission of specific UT-GOM2-2 permits that are only valid for a limited term. These includes the BOEM Application for Permit to Conduct Geological or Geophysical Exploration for Mineral Resources or Scientific Research on the Outer Continental Shelf, Bureau of Safety and Environmental Enforcement (BSEE) Application for Permit to Drill (APD), the National Pollutant Discharge Elimination System (NPDES) Notice of Intent (NOI), and the US Coast Guard (USCG) Letter of Determination (LOD).

1.2.2.7.3 Subtask 15.4 – Review and Complete NEPA Requirements

Status: In Progress

- UT submitted a NEPA Environmental Questionnaire (EQ) to US DOE-NETL on Feb. 22. A NEPA Categorical Exclusion was granted on Mar. 10.
- UT will complete a NEPA EQ for the dockside science location once confirmed by Helix.

1.2.2.7.4 Subtask 15.5 – Finalize Operational Plan for UT-GOM2-2 Scientific Drilling Program

Status: Complete (Milestones M5C, M5E)

1.2.2.8 Task 16.0 – UT-GOM2-2 Scientific Drilling Program Field Operations

Status: Future Task

1.2.2.8.1 Subtask 16.1 – Mobilization of Scientific Ocean Drilling and Pressure Coring Capability

Future Task.

1.2.2.8.2 Subtask 16.2 – Field Project Management, Operations, and Research

Future Task.

1.2.2.8.3 Subtask 16.3 – Demobilization of Staff, Labs, and Equipment

Future Task.

1.3 What Will Be Done In The Next Reporting Period To Accomplish These Goals

1.3.1 Task 1.0 – Project Management & Planning

- UT will continue to execute the project in accordance with the approved Project Management Plan and Statement of Project Objectives.
- UT will continue to manage and control project activities in accordance with their established processes and procedures to ensure subtasks and tasks are completed within schedule and budget constraints defined by the Project Management Plan.
- UT will execute contracts with third party contractors (e.g. Geotek) to perform UT-GOM2-2 in 2023.
- UT will review and analyze project budget and schedule implications for delaying the UT-GOM2-2 field program, and will notify the DOE Project Manager of findings and proposed a plan forward.

1.3.2 Task 10.0 – Core Analysis

- UT will continue to perform benchmark studies using resedimented material to identify the optimal test protocol to run uniaxial strain conditions.
- UT will continue analyzing the petrophysical and geomechanical properties of pressure cores using the UT Effective Stress Chamber. The updated test protocols will provide more reliable measurements.
- Oregon State will continue working on improving DNA extraction techniques for UT-GOM2-2
- Ohio State with UT will continue developing reference hydrate saturation curves for UT-GOM2-2
- UT, Ohio State, UW, UNH, Oregon State, and Tufts will continue working on UT-GOM2-2 protocols and supply lists
- AAPG Editors will continue working on the publication of the second special volume of our findings from GC 955.

1.3.3 Task 11.0 – Update Operations Plan for UT-GOM2-2 Scientific Drilling Program

- Task Complete

1.3.4 Task 12.0 – UT-GOM2-2 Scientific Drilling Program Vessel Access

- Task Complete

1.3.5 Task 13.0 – Maintenance And Refinement Of Pressure Core Transport, Storage, & Manipulation Capability

- The Mini-PCATS, PMRS, analytical equipment, and storage chambers will undergo continued observation and maintenance at regularly scheduled intervals and on an as-needed basis. Installation of new or replacement parts will continue to ensure operational readiness.
- UT will work with Geotek to ship the equipment upgrade for monitoring of the temperature of a sample in the Effective Stress Chamber. UT will accept delivery of the temperature monitoring upgrade for the Effective Stress Chamber. UT will then determine when to install and test the upgrade to ensure operational quality.
- UT will accept delivery of a third 100kN load cell for the Effective Stress Chamber test sections to ensure full operation of all three test sections. UT will install a new gearbox on the Effective Stress Chamber with a higher gear ratio to ensure greater axial loading capability via mechanical operation. UT will generate an update design of the single, quad-configuration support base for core storage expansion.
- UT will continue to evaluate the new pump modes/software developed to conduct uniaxial strain tests either compensating for apparatus compressibility or by adjusting the confining volume to match axial and volumetric strains.

1.3.6 Task 14.0 – Performance Assessment, Modifications, And Testing Of PCTB

- Task complete.

1.3.7 Task 15.0 – UT-GOM2-2 Scientific Drilling Program Preparations

- UT will continue to evaluate what amendments or modifications to currently approved permits will be required by BOEM as a result of shifting the UT-GOM2-2 expedition schedule from 2022-2023.
- Helix will continue to request quotes from various third-party subcontractors and UT will provide specification guidance to Helix regarding required services, materials, equipment, and personnel.
- UT will complete a NEPA Environmental Questionnaire for the dockside science location once it is confirmed by Helix.

1.3.8 Task 16.0 – UT-GOM2-2 Scientific Drilling Program Field Operations

- Future Task.

2 PRODUCTS

Project publications webpage: https://ig.utexas.edu/energy/gom2-methane-hydrates-at-the-university-of-texas/gom2-publications/

2.1 Publications

Boswell, R., Collet, T.C., Cook, A.E., Flemings, P.B., 2020, Introduction to Special Issue: Gas Hydrates in Green Canyon Block 955, deep-water Gulf of Mexico: Part I: AAPG Bulletin, v. 104, no. 9, p. 1844-1846, http://dx.doi.org/10.1306/bltnintro062320.

Chen, X., and Espinoza, D. N., 2018a, Ostwald ripening changes the pore habit and spatial variability of clathrate hydrate: Fuel, v. 214, p. 614-622. https://doi.org/10.1016/j.fuel.2017.11.065

Chen, X., Verma, R., Espinoza, D. N., and Prodanović, M., 2018, Pore-Scale Determination of Gas Relative Permeability in Hydrate-Bearing Sediments Using X-Ray Computed Micro-Tomography and Lattice Boltzmann Method: Water Resources Research, v. 54, no. 1, p. 600-608. https://doi.org/10.1002/2017wr021851

Chen, X. Y., and Espinoza, D. N., 2018b, Surface area controls gas hydrate dissociation kinetics in porous media: Fuel, v. 234, p. 358-363. https://doi.org/10.1016/j.fuel.2018.07.030

Cook, A. E., and Portnov, A., 2019, Gas hydrates in coarse-grained reservoirs interpreted from velocity pull up: Mississippi Fan, Gulf of Mexico: COMMENT: Geology, v. 47, no. 3, p. e457-e457. https://doi.org/10.1130/g45609c.1

Cook, A. E., and Sawyer, D. E., 2015, The mud-sand crossover on marine seismic data: Geophysics, v. 80, no. 6, p. A109-A114. https://doi.org/10.1190/geo2015-0291.1

Cook, A. E., and Waite, W. F., 2018, Archie's Saturation Exponent for Natural Gas Hydrate in Coarse-Grained Reservoirs, v. 123, no. 3, p. 2069-2089. https://doi.org/10.1002/2017jb015138

Darnell, K. N., and Flemings, P. B., 2015, Transient seafloor venting on continental slopes from warming-induced methane hydrate dissociation: Geophysical Research Letters, p. n/a-n/a. https://doi.org/10.1002/2015GL067012

Darnell, K. N., Flemings, P. B., and DiCarlo, D., 2019, Nitrogen-Driven Chromatographic Separation During Gas Injection Into Hydrate-Bearing Sediments: Water Resources Research. https://doi.org/10.1029/2018wr023414

Ewton, E., 2019, The effects of X-ray CT scanning on microbial communities in sediment coresHonors]: Oregon State University, 21 p.

Fang, Y., Flemings, P. B., Daigle, H., Phillips, S. C., Meazell, P. K., and You, K., 2020, Petrophysical properties of the Green Canyon block 955 hydrate reservoir inferred from reconstituted sediments: Implications for hydrate formation and production: AAPG Bulletin, v. 104, no. 9, p. 1997–2028, https://doi.org/10.1306/01062019165

Flemings, P. B., Phillips, S. C., Boswell, R., Collett, T. S., Cook, A. E., Dong, T., Frye, M., Guerin, G., Goldberg, D. S., Holland, M. E., Jang, J., Meazell, K., Morrison, J., O'Connell, J., Pettigrew, T., Petrou, E., Polito, P. J., Portnov, A., Santra, M., Schultheiss, P. J., Seol, Y., Shedd, W., Solomon, E. A., Thomas, C., Waite, W. F., and You, K., 2020, Pressure coring a Gulf of Mexico Deepwater Turbidite Gas Hydrate Reservoir: Initial results from the UT-GOM2-1 hydrate pressure coring expedition: AAPG Bulletin, v. 104, no. 9, p. 1847-1876. https://doi.org/10.1306/05212019052

Flemings, P. B., Phillips, S. C., Collett, T., Cook, A., Boswell, R., and Scientists, U.-G.-E., 2018, UT-GOM2-1 Hydrate Pressure Coring Expedition Summary, *in* Flemings, P. B., Phillips, S. C., Collett, T., Cook, A., Boswell, R., and Scientists, U.-G.-E., eds., UT-GOM2-1 Hydrate Pressure Coring Expedition Report: Austin, TX, University of Texas Institute for Geophysics.

Hillman, J. I. T., Cook, A. E., Daigle, H., Nole, M., Malinverno, A., Meazell, K., and Flemings, P. B., 2017a, Gas hydrate reservoirs and gas migration mechanisms in the Terrebonne Basin, Gulf of Mexico: Marine and Petroleum Geology, v. 86, no. Supplement C, p. 1357-1373. https://doi.org/10.1016/j.marpetgeo.2017.07.029

Hillman, J. I. T., Cook, A. E., Sawyer, D. E., Küçük, H. M., and Goldberg, D. S., 2017b, The character and amplitude of 'discontinuous' bottom-simulating reflections in marine seismic data: Earth and Planetary Science Letters, v. 459, p. 157-169. https://doi.org/10.1016/j.epsl.2016.10.058

Johnson, J.E., MacLeod, D.R., Phillips, S.C., Purkey Phillips, M., Divins, D.L., 2022. Primary deposition and early diagenetic effects on the high saturation accumulation of gas hydrate in a silt dominated reservoir in the Gulf of Mexico. Marine Geology, Volume 444, 2022, 106718, https://doi.org/10.1016/j.margeo.2021.106718.

MacLeod, D.R., 2020. Characterization of a silty methane-hydrate reservoir in the Gulf of Mexico: Analysis of full sediment grain size distributions. M.S. Thesis, pp. 165, University of New Hampshire, Durham NH, U.S.A.

Majumdar, U., and Cook, A. E., 2018, The Volume of Gas Hydrate-Bound Gas in the Northern Gulf of Mexico: Geochemistry, Geophysics, Geosystems, v. 19, no. 11, p. 4313-4328. https://doi.org/10.1029/2018gc007865

Majumdar, U., Cook, A. E., Shedd, W., and Frye, M., 2016, The connection between natural gas hydrate and bottom-simulating reflectors: Geophysical Research Letters. https://doi.org/10.1002/2016GL069443

Meazell, K., Flemings, P., Santra, M., and Johnson, J. E., 2020, Sedimentology and stratigraphy of a deepwater gas hydrate reservoir in the northern Gulf of Mexico: AAPG Bulletin, v. 104, no. 9, p. 1945–1969, https://doi.org/10.1306/05212019027

Meyer, D. W., 2018, Dynamics of gas flow and hydrate formation within the hydrate stability zone [Doctor of Philosophy: The University of Texas at Austin.

Meyer, D. W., Flemings, P. B., and DiCarlo, D., 2018a, Effect of Gas Flow Rate on Hydrate Formation Within the Hydrate Stability Zone: Journal of Geophysical Research-Solid Earth, v. 123, no. 8, p. 6263-6276. https://doi.org/10.1029/2018jb015878

Meyer, D. W., Flemings, P. B., DiCarlo, D., You, K. H., Phillips, S. C., and Kneafsey, T. J., 2018b, Experimental Investigation of Gas Flow and Hydrate Formation Within the Hydrate Stability Zone: Journal of Geophysical Research-Solid Earth, v. 123, no. 7, p. 5350-5371. https://doi.org/10.1029/2018jb015748

Moore, M., Phillips, S., Cook, A.E. and Darrah, T., (2020) Improved sampling technique to collect natural gas from hydrate-bearing pressure cores. Applied Geochemistry, Volume 122, November 2020, p. 104773, https://doi.org/10.1016/j.apgeochem.2020.104773.

Phillips, S. C., Flemings, P. B., Holland, M. E., Schulthiss, P. J., Waite, W. F., Jang, J., Petrou, E. G., and H., H., 2020, High concentration methane hydrate in a silt reservoir from the deep-water Gulf of Mexico: AAPG Bulletin, v. 104, no. 9, p. 1971–1995. https://doi.org/10.1306/01062018280

Phillips, S. C., Flemings, P. B., You, K., Meyer, D. W., and Dong, T., 2019, Investigation of in situ salinity and methane hydrate dissociation in coarse-grained sediments by slow, stepwise depressurization: Marine and Petroleum Geology, v. 109, p. 128-144. https://doi.org/10.1016/j.marpetgeo.2019.06.015

Portnov, A., Cook, A. E., Heidari, M., Sawyer, D. E., Santra, M., and Nikolinakou, M., 2020, Salt-driven evolution of a gas hydrate reservoir in Green Canyon, Gulf of Mexico: AAPG Bulletin, v. 104, no. 9, p. 1903–1919, http://dx.doi.org/10.1306/10151818125

Portnov, A., Cook, A. E., Sawyer, D. E., Yang, C., Hillman, J. I. T., and Waite, W. F., 2019, Clustered BSRs: Evidence for gas hydrate-bearing turbidite complexes in folded regions, example from the Perdido Fold Belt, northern Gulf of Mexico: Earth and Planetary Science Letters, v. 528. https://doi.org/10.1016/j.epsl.2019.115843

Portnov, A., Santra, M., Cook., A.E., and Sawyer, D.E, (2020, accepted & online) The Jackalope gas hydrate system in the northeastern Gulf of Mexico. Journal of Marine and Petroleum Geology. https://doi.org/10.1016/j.marpetgeo.2019.08.036

Santra, M., Flemings, P., Meazell, K., and Scott, E., 2020, Evolution of Gas Hydrate-bearing Deepwater Channel-Levee System in Abyssal Gulf of Mexico – Levee Growth and Deformation: : AAPG Bulletin, v. 104, no. 9, p. 1921–1944, https://doi.org/10.1306/04251918177

Sawyer, D. E., Mason, R. A., Cook, A. E., and Portnov, A., 2019, Submarine Landslides Induce Massive Waves in Subsea Brine Pools: Scientific Reports, v. 9, no. 1, p. 128. https://doi.org/10.1038/s41598-018-36781-7

Sheik, C. S., Reese, B. K., Twing, K. I., Sylvan, J. B., Grim, S. L., Schrenk, M. O., Sogin, M. L., and Colwell, F. S., 2018, Identification and Removal of Contaminant Sequences From Ribosomal Gene Databases: Lessons From the Census of Deep Life: Front Microbiol, v. 9, p. 840. https://doi.org/10.3389/fmicb.2018.00840

Smart, K (2018). Modeling Well Log Responses in Hydrate Bearing Silts. Ohio State University. Undergraduate Thesis.

Smith, A. J., Flemings, P. B., Liu, X., and Darnell, K., 2014, The evolution of methane vents that pierce the hydrate stability zone in the world's oceans: Journal of Geophysical Research: Solid Earth, p. 2013JB010686. https://doi.org/10.1002/2013JB010686

Thomas, C., Phillips, S. C., Flemings, P. B., Santra, M., Hammon, H., Collett, T. S., Cook, A., Pettigrew, T., Mimitz, M., Holland, M., and Schultheiss, P., 2020, Pressure-coring operations during the University of Texas Hydrate Pressure Coring Expedition, UT-GOM2-1, in Green Canyon Block 955, northern Gulf of Mexico: AAPG Bulletin, v. 104, no. 9, p. 1877–1901. https://doi.org/10.1306/02262019036

Wei, L., Cook, A., Daigle, H., Malinverno, A., Nole, M., and You, K., 2019, Factors Controlling Short-Range Methane Migration of Gas Hydrate Accumulations in Thin Coarse-Grained Layers: Geochemistry, Geophysics, Geosystems, v. 20, no. 8, p. 3985-4000. https://doi.org/10.1029/2019gc008405

You, K., Summa, L., Flemings, P., Santra, M., and Fang, Y., 2021, Three-Dimensional Free Gas Flow Focuses Basin Wide Microbial Methane to Concentrated Methane Hydrate Reservoirs in Geological System: Journal of Geophysical Research: Solid Earth, v. 126, no. 12, p. e2021JB022793. https://doi.org/https://doi.org/10.1029/2021JB022793

You, K., and Flemings, P. B., 2018, Methane hydrate formation in thick sandstones by free gas flow: Journal of Geophysical Research: Solid Earth, v. 123, p. 4582-4600. https://doi.org/10.1029/2018JB015683

You, K., Flemings, P. B., Malinverno, A., Collett, T. S., and Darnell, K., 2019, Mechanisms of Methane Hydrate Formation in Geological Systems: Reviews of Geophysics, v. 0, no. ja. https://doi.org/10.1029/2018rg000638

You, K., Kneafsey, T. J., Flemings, P. B., Polito, P., and Bryant, S. L., 2015, Salinity-buffered methane hydrate formation and dissociation in gas-rich systems: Journal of Geophysical Research: Solid Earth, v. 120, no. 2, p. 643-661. https://doi.org/10.1002/2014JB011190

You, K., Summa, L., Flemings, P. B., Santra, M., and Fang, Y., (2021), Three-dimensional free gas flow focuses basin-wide microbial methane to concentrated methane hydrate reservoirs in geological system, Journal of Geophysical Research: Solid Earth, 126, e2021JB022793.

You K., and Flemings, P. B., (2021), Methane hydrate formation and evolution during sedimentation, Journal of Geophysical Research: Solid Earth, 126, e2020JB021235.

2.2 Conference Presentations/Abstracts

Colwell, F., Kiel Reese, B., Mullis, M., Buser-Young, J., Glass, J.B., Waite, W., Jang, J., Dai, S., Phillips, S. 2020. Microbial Communities in Hydrate-Bearing Sediments Following Long-Term Pressure Preservation. Presented as a poster at 2020 Gordon Research Conference on Gas Hydrates

Cook. A., Waite, W. F., Spangenberg, E., and Heeschen, K.U., 2018, Petrophysics in the lab and the field: how can we understand gas hydrate pore morphology and saturation? Invited talk presented at the American Geophysical Union Fall Meeting, Washington D.C.

Cook, A.E., and Waite, B., 2016, Archie's saturation exponent for natural gas hydrate in coarse-grained reservoir. Presented at Gordon Research Conference, Galveston, TX.

Cook, A.E., Hillman, J., Sawyer, D., Treiber, K., Yang, C., Frye, M., Shedd, W., Palmes, S., 2016, Prospecting for Natural Gas Hydrate in the Orca & Choctaw Basins in the Northern Gulf of Mexico. Poster presented at American Geophysical Union, Fall Meeting, San Francisco, CA.

Cook, A.E., Hillman, J., & Sawyer, D., 2015, Gas migration in the Terrebonne Basin gas hydrate system. Abstract OS23D-05 presented at American Geophysical Union, Fall Meeting, San Francisco, CA.

Cook, A. E., & Sawyer, D., 2015, Methane migration in the Terrebonne Basin gas hydrate system, Gulf of Mexico. Presented at American Geophysical Union, Fall Meeting, San Francisco, CA.

Chen X., Espinoza, D.N., Tisato, N., and Flemings, P.B., 2018, X-Ray Micro-CT Observation of Methane Hydrate Growth in Sandy Sediments. Presented at the AGU Fall Meeting 2018, Dec. 10–14, in Washington D.C.

Darnell, K., Flemings, P.B., DiCarlo, D.A., 2016, Nitrogen-assisted Three-phase Equilibrium in Hydrate Systems Composed of Water, Methane, Carbon Dioxide, and Nitrogen. Presented at American Geophysical Union, Fall Meeting, San Francisco, CA.

Dong, T., Lin, J. -F., Flemings, P. B., Gu, J. T., Polito, P. J., O'Connell, J., 2018, Pore-Scale Methane Hydrate Formation under Pressure and Temperature Conditions of Natural Reservoirs. Presented to the AGU Fall Meeting 2018, Washington D.C., 10-14 December.

Ewton, E., Klasek, S., Peck, E., Wiest, J. Colwell F., 2019, The effects of X-ray computed tomography scanning on microbial communities in sediment cores. Poster presented at AGU Fall Meeting.

Erica Ewton et al., 2018, The effects of X-ray CT scanning on microbial communities in sediment cores. Poster presented at American Geophysical Union, Fall Meeting, Washington, D.C. OS23D-1657

Espinoza D.N., Chen X., Luo J.S., Tisato N., Flemings P.B., 2010, X-Ray Micro-CT Observation of Methane Hydrate Growth and Dissociation in Sandy Sediments. Presented to the Engineering Mechanics Institute Conference 2019, Pasadena, CA, 19 June.

Fang, Y., et al., 2020, Petrophysical Properties of Hydrate-Bearing Siltstone from UT-GOM2-1 Pressure Cores. Presented at the AAPG virtual Conference, Oct 1, Theme 9: Analysis of Natural Gas Hydrate Systems I & II

Fang, Y., et al., 2018, Permeability, compression behavior, and lateral stress ration of hydrate-bearing siltstone from UT-GOM2-1 pressure core (GC-955 – northern Gulf of Mexico): Initial Results. Poster presented at American Geophysical Union, Fall Meeting, Washington, D.C. OS23D-1650

Fang, Y., Flemings, P.B., Daigle, H., O'Connell, J., Polito, P., 2018, Measure permeability of natural hydrate-bearing sediments using K0 permeameter. Presented at Gordon Research Conference on Gas Hydrate, Galveston, TX. Feb 24- Mar 02, 2018.

Flemings, P.B., et al., 2020 Pressure Coring a Gulf of Mexico Deep-Water Turbidite Gas Hydrate Reservoir: The UT-GOM2-1 Hydrate Pressure Coring Expedition. Presented at the AAPG virtual Conference, Oct 1, Theme 9: Analysis of Natural Gas Hydrate Systems I & II

Flemings, P., Phillips, S., and the UT-GOM2-1 Expedition Scientists, 2018, Recent results of pressure coring hydrate-bearing sands in the deepwater Gulf of Mexico: Implications for formation and production. Talk presented at the 2018 Gordon Research Conference on Natural Gas Hydrate Systems, Galveston, TX, February 24-March 2, 2018.

Fortin, W., 2018, Waveform Inversion and Well Log Examination at GC955 and WR313 in the Gulf of Mexico for Estimation of Methane Hydrate Concentrations. Presented at Gordon Research Conference on Natural Gas Hydrate Systems, Galveston, TX.

Fortin, W., Goldberg, D.S., Küçük, H. M., 2017, Prestack Waveform Inversion and Well Log Examination at GC955 and WR313 in the Gulf of Mexico for Estimation of Methane Hydrate Concentrations. EOS Trans. American Geophysical Union, Fall Meeting, New Orleans, LA.

Fortin, W., 2016, Properties from Seismic Data. Presented at IODP planning workshop, Southern Methodist University, Dallas, TX.

Fortin, W., Goldberg, D.S., Holbrook, W.S., and Küçük, H.M., 2016, Velocity analysis of gas hydrate systems using prestack waveform inversion. Presented at Gordon Research Conference on Natural Gas Hydrate Systems, Galveston, TX.

Fortin, W., Goldberg, D.S., Küçük, H.M., 2016, Methane Hydrate Concentrations at GC955 and WR313 Drilling Sites in the Gulf of Mexico Determined from Seismic Prestack Waveform Inversion. EOS Trans. American Geophysical Union, Fall Meeting, San Francisco, CA.

Goldberg, D., Küçük, H.M., Haines, S., Guerin, G., 2016, Reprocessing of high resolution multichannel seismic data in the Gulf of Mexico: implications for BSR character in the Walker Ridge and Green Canyon areas. Presented at Gordon Research Conference on Natural Gas Hydrate Systems, Galveston, TX.

Hammon, H., Phillips, S., Flemings, P., and the UT-GOM2-1 Expedition Scientists, 2018, Drilling-induced disturbance within methane hydrate pressure cores in the northern Gulf of Mexico. Poster presented at the 2018 Gordon Research Conference and Seminar on Natural Gas Hydrate Systems, Galveston, TX, February 24-March 2, 2018.

Heber, R., Kinash, N., Cook, A., Sawyer, D., Sheets, J., and Johnson, J.E., 2017, Mineralogy of Gas Hydrate Bearing Sediment in Green Canyon Block 955 Northern Gulf of Mexico. Abstract OS53B-1206 presented at American Geophysical Union, Fall Meeting, New Orleans, LA.

Hillman, J., Cook, A. & Sawyer, D., 2016, Mapping and characterizing bottom-simulating reflectors in 2D and 3D seismic data to investigate connections to lithology and frequency dependence. Presented at Gordon Research Conference, Galveston, TX.

Johnson, J., et al., 2020, Grain Size, TOC, and TS in Gas Hydrate Bearing Turbidite Facies at Green Canyon Site 955, Gulf of Mexico. Presented at the AAPG virtual Conference, Oct 1, Theme 9: Analysis of Natural Gas Hydrate Systems I & II

Johnson, J.E., Phillips, S.C., and Divins, D.L., 2018, Tracking AOM through TOC and Elemental S: Implications for Methane Charge in Gulf of Mexico Marine Sediments. Abstract OS13A-08 presented at 2018 Fall Meeting, AGU, San Francisco, Calif., 14-18 Dec. Oral Presentation

Johnson, J., 2018, High Porosity and Permeability Gas Hydrate Reservoirs: A Sedimentary Perspective. Presented at Gordon Research Conference on Natural Gas Hydrate Systems, Galveston, TX.

Kinash, N. Cook, A., Sawyer, D. and Heber, R., 2017, Recovery and Lithologic Analysis of Sediment from Hole UT-GOM2-1-H002, Green Canyon 955, Northern Gulf of Mexico. Abstract OS53B-1207 presented at American Geophysical Union, Fall Meeting, New Orleans, LA.

Küçük, H.M., Goldberg, D.S, Haines, S., Dondurur, D., Guerin, G., and Çifçi, G., 2016, Acoustic investigation of shallow gas and gas hydrates: comparison between the Black Sea and Gulf of Mexico. Presented at Gordon Research Conference on Natural Gas Hydrate Systems, Galveston, TX.

Liu, J. et al., 2018, Pore-scale CH4-C2H6 hydrate formation and dissociation under relevant pressure-temperature conditions of natural reservoirs. Poster presented at American Geophysical Union, Fall Meeting, Washington, D.C. OS23D-2824

Malinverno, A., Cook, A. E., Daigle, H., Oryan, B., 2017, Methane Hydrate Formation from Enhanced Organic Carbon Burial During Glacial Lowstands: Examples from the Gulf of Mexico. EOS Trans. American Geophysical Union, Fall Meeting, New Orleans, LA.

Malinverno, A., 2016, Modeling gas hydrate formation from microbial methane in the Terrebonne basin, Walker Ridge, Gulf of Mexico. Presented at Gordon Research Conference on Natural Gas Hydrate Systems, Galveston, TX.

Meazell, K., and Flemings, P.B., 2021, Seal capacity and fluid expulsion in hydrate systems. Presented at IMAGE 2021, SEG/AAPG Annual Conference. Denver, Colorado. Theme 9: Hydrocarbons of the future.

Meazell, K., Flemings, P. B., Santra, M., and the UT-GOM2-01 Scientists, 2018, Sedimentology of the clastic hydrate reservoir at GC 955, Gulf of Mexico. Presented at Gordon Research Conference on Natural Gas Hydrate Systems, Galveston, TX.

Meazell, K., & Flemings, P.B., 2016, Heat Flux and Fluid Flow in the Terrebonne Basin, Northern Gulf of Mexico. Presented at American Geophysical Union, Fall Meeting, San Francisco, CA.

Meazell, K., & Flemings, P.B., 2016, New insights into hydrate-bearing clastic sediments in the Terrebonne basin, northern Gulf of Mexico. Presented at Gordon Research Conference on Natural Gas Hydrate Systems, Galveston, TX.

Meazell, K., & Flemings, P.B., 2016, The depositional evolution of the Terrebonne basin, northern Gulf of Mexico. Presented at 5th Annual Jackson School Research Symposium, University of Texas at Austin, Austin, TX.

Meazell, K., 2015, Methane hydrate-bearing sediments in the Terrebonne basin, northern Gulf of Mexico. Abstract OS23B-2012 presented at American Geophysical Union, Fall Meeting, San Francisco, CA.

Moore, M., Darrah, T., Cook, A., Sawyer, D., Phillips, S., Whyte, C., Lary, B., and UT-GOM2-01 Scientists, 2017, The genetic source and timing of hydrocarbon formation in gas hydrate reservoirs in Green Canyon, Block GC955. Abstract OS44A-03 presented at American Geophysical Union, Fall Meeting, New Orleans, LA.

Morrison, J., Flemings, P., and the UT-GOM2-1 Expedition Scientists, 2018, Hydrate Coring in Deepwater Gulf of Mexico, USA. Poster presented at the 2018 Gordon Research Conference on Natural Gas Hydrate Systems, Galveston, TX.

Murphy, Z., et al., 2018, Three phase relative permeability of hydrate bearing sediments. Poster presented at American Geophysical Union, Fall Meeting, Washington, D.C. OS23D-1647

Naim, F., Cook, A., Konwar, D. (2021) Estimating P-wave velocity and Bulk Density in Hydrate Systems using Machine Learning, in IMAGE 2021, SEG/AAPG Annual Conference. Denver, Colorado

Oryan, B., Malinverno, A., Goldberg, D., Fortin, W., 2017, Do Pleistocene glacial-interglacial cycles control methane hydrate formation? An example from Green Canyon, Gulf of Mexico. EOS Trans. American Geophysical Union, Fall Meeting, New Orleans, LA.

Oti, E., Cook, A., Phillips, S., and Holland, M., 2019, Using X-ray Computed Tomography (XCT) to Estimate Hydrate Saturation in Sediment Cores from UT-GOM2-1 H005, Green Canyon 955 (Invited talk, U11C-17). Presented to the AGU Fall Meeting, San Francisco, CA.

Oti, E., Cook. A., Phillips, S., Holland, M., Flemings, P., 2018, Using X-ray computed tomography to estimate hydrate saturation in sediment cores from Green Canyon 955 Gulf of Mexico. Talk presented at the American Geophysical Union Fall Meeting, Washington D.C.

Oti, E., Cook, A., 2018, Non-Destructive X-ray Computed Tomography (XCT) of Previous Gas Hydrate Bearing Fractures in Marine Sediment. Presented at Gordon Research Conference on Natural Gas Hydrate Systems, Galveston, TX.

Oti, E., Cook, A., Buchwalter, E., and Crandall, D., 2017, Non-Destructive X-ray Computed Tomography (XCT) of Gas Hydrate Bearing Fractures in Marine Sediment. Abstract OS44A-05 presented at American Geophysical Union, Fall Meeting, New Orleans, LA.

Phillips, S.C., et al., 2020, High Concentration Methane Hydrate in a Silt Reservoir from the Deep-Water Gulf of Mexico. Presented at the AAPG virtual Conference, Oct 1, Theme 9: Analysis of Natural Gas Hydrate Systems I & II

Phillips, S.C., Formolo, M.J., Wang, D.T., Becker, S.P., and Eiler, J.M., 2020. Methane isotopologues in a high-concentration gas hydrate reservoir in the northern Gulf of Mexico. Goldschmidt Abstracts 2020. https://goldschmidtabstracts.info/2020/2080.pdf

Phillips, S.C., 2019, Pressure coring in marine sediments: Insights into gas hydrate systems and future directions. Presented to the GSA Annual Meeting 2019, Phoenix, Arizona, 22-25 September. https://gsa.confex.com/gsa/2019AM/meetingapp.cgi/Paper/338173

Phillips et al., 2018, High saturation of methane hydrate in a coarse-grained reservoir in the northern Gulf of Mexico from quantitative depressurization of pressure cores. Poster presented at American Geophysical Union, Fall Meeting, Washington, D.C. OS23D-1654

Phillips, S.C., Flemings, P.B., Holland, M.E., Schultheiss, P.J., Waite, W.F., Petrou, E.G., Jang, J., Polito, P.J., O'Connell, J., Dong, T., Meazell, K., and Expedition UT-GOM2-1 Scientists, 2017, Quantitative degassing of gas hydrate-bearing pressure cores from Green Canyon 955. Gulf of Mexico. Talk and poster presented at the 2018 Gordon Research Conference and Seminar on Natural Gas Hydrate Systems, Galveston, TX, February 24-March 2, 2018.

Phillips, S.C., Borgfedlt, T., You, K., Meyer, D., and Flemings, P., 2016, Dissociation of laboratory-synthesized methane hydrate by depressurization. Poster presented at Gordon Research Conference and Gordon Research Seminar on Natural Gas Hydrates, Galveston, TX.

Phillips, S.C., You, K., Borgfeldt, T., Meyer, D.W., Dong, T., Flemings, P.B., 2016, Dissociation of Laboratory-Synthesized Methane Hydrate in Coarse-Grained Sediments by Slow Depressurization. Presented at American Geophysical Union, Fall Meeting, San Francisco, CA.

Portnov, A., Cook, A. E., Frye, M. C., Palmes, S. L., Skopec, S., 2021, Prospecting for Gas Hydrate Using Public Geophysical Data in the Northern Gulf of Mexico. Presented at in IMAGE 2021, SEG/AAPG Annual Conference. Denver, Colorado. Theme 9: Hydrocarbons of the future.

Portnov A., et al., 2018, Underexplored gas hydrate reservoirs associated with salt diapirism and turbidite deposition in the Northern Gulf of Mexico. Poster presented at American Geophysical Union, Fall Meeting, Washington, D.C. OS51F-1326

Portnov, A., Cook, A., Heidari, M., Sawyer, D., Santra, M., Nikolinakou, M., 2018, Salt-driven Evolution of Gas Hydrate Reservoirs in the Deep-sea Gulf of Mexico. Presented at Gordon Research Conference on Natural Gas Hydrate Systems, Galveston, TX.

Santra, M., et al., 2020, Gas Hydrate in a Fault-Compartmentalized Anticline and the Role of Seal, Green Canyon, Abyssal Northern Gulf of Mexico. Presented at the AAPG virtual Conference, Oct 1, Theme 9: Analysis of Natural Gas Hydrate Systems I & II

Santra, M., et al., 2018, Channel-levee hosted hydrate accumulation controlled by a faulted anticline: Green Canyon, Gulf of Mexico. Poster presented at American Geophysical Union, Fall Meeting, Washington, D.C. OS51F-1324

Santra, M., Flemings, P., Scott, E., Meazell, K., 2018, Evolution of Gas Hydrate Bearing Deepwater Channel-Levee System in Green Canyon Area in Northern Gulf of Mexico. Presented at Gordon Research Conference and Gordon Research Seminar on Natural Gas Hydrates, Galveston, TX.

Treiber, K, Sawyer, D., & Cook, A., 2016, Geophysical interpretation of gas hydrates in Green Canyon Block 955, northern Gulf of Mexico, USA. Poster presented at Gordon Research Conference, Galveston, TX.

Varona, G., Flemings, P.B., Santra, M., Meazell, K., 2021, Paleogeographic evolution of the Green Sand, WR313. Presented at in IMAGE 2021, SEG/AAPG Annual Conference. Denver, Colorado. Theme 9 Gas Hydrates and Helium Sourcing.

Wei, L. and Cook, A., 2019, Methane Migration Mechanisms and Hydrate Formation at GC955, Northern Gulf of Mexico. Abstract OS41B-1668 presented to the AGU Fall Meeting, San Francisco, CA.

Wei, L., Cook, A. and You, K., 2020, Methane Migration Mechanisms for the GC955 Gas Hydrate Reservoir, Northern Gulf of Mexico. Abstract OS029-0008. AGU 2020 Fall Meeting

Worman, S. and, Flemings, P.B., 2016, Genesis of Methane Hydrate in Coarse-Grained Systems: Northern Gulf of Mexico Slope (GOM^2). Poster presented at The University of Texas at Austin, GeoFluids Consortia Meeting, Austin, TX.

Yang, C., Cook, A., & Sawyer, D., 2016, Geophysical interpretation of the gas hydrate reservoir system at the Perdido Site, northern Gulf of Mexico. Presented at Gordon Research Conference, Galveston, TX, United States.

You, K., M. Santra, L. Summa, and P.B. Flemings, 2020, Impact of focused free gas flow and microbial methanogenesis kinetics on the formation and evolution of geological gas hydrate system, Abstract presented at 2020 AGU Fall Meeting, 1-17 Dec, Virtual

You, K., et al. 2020, Impact of Coupled Free Gas Flow and Microbial Methanogenesis on the Formation and Evolution of Concentrated Hydrate Deposits. Presented at the AAPG virtual Conference, Oct 1, Theme 9: Analysis of Natural Gas Hydrate Systems I & II

You, K., Flemings, P. B., and Santra, M., 2018, Formation of lithology-dependent hydrate distribution by capillary-controlled gas flow sourced from faults. Poster presented at American Geophysical Union, Fall Meeting, Washington, D.C. OS31F-1864

You, K., and Flemings, P. B., 2018, Methane Hydrate Formation in Thick Marine Sands by Free Gas Flow. Presented at Gordon Research Conference on Gas Hydrate, Galveston, TX. Feb 24- Mar 02, 2018.

You, K., Flemings, P.B., 2016, Methane Hydrate Formation in Thick Sand Reservoirs: Long-range Gas Transport or Short-range Methane Diffusion? Presented at American Geophysical Union, Fall Meeting, San Francisco, CA.

You, K.Y., DiCarlo, D. & Flemings, P.B., 2015, Quantifying methane hydrate formation in gas-rich environments using the method of characteristics. Abstract OS23B-2005 presented at 2015, Fall Meeting, AGU, San Francisco, CA, 14-18 Dec.

You, K.Y., Flemings, P.B., & DiCarlo, D., 2015, Quantifying methane hydrate formation in gas-rich environments using the method of characteristics. Poster presented at 2016 Gordon Research Conference and Gordon Research Seminar on Natural Gas Hydrates, Galveston, TX.

2.3 Proceeding of the UT-GOM2-1 Hydrate Pressure Coring Expedition

Volume contents are published on the UT-GOM2-1 Expedition website and on OSTI.gov.

2.3.1 Volume Reference

Flemings, P.B., Phillips, S.C, Collett, T., Cook, A., Boswell, R., and the UT-GOM2-1 Expedition Scientists, Proceedings of the UT-GOM2-1 Hydrate Pressure Coring Expedition, Austin, TX (University of Texas Institute for Geophysics, TX), https://dx.doi.org/10.2172/1646019

2.3.2 Prospectus

Flemings, P.B., Boswell, R., Collett, T.S., Cook, A. E., Divins, D., Frye, M., Guerin, G., Goldberg, D.S., Malinverno, A., Meazell, K., Morrison, J., Pettigrew, T., Philips, S.C., Santra, M., Sawyer, D., Shedd, W., Thomas, C., You, K. GOM2: Prospecting, Drilling and Sampling Coarse-Grained Hydrate Reservoirs in the Deepwater Gulf of Mexico. Proceeding of ICGH-9. Denver, Colorado: ICGH, 2017. http://www-udc.ig.utexas.edu/gom2/UT-GOM2-1%20Prospectus.pdf.

2.3.3 Expedition Report Chapters

Flemings, P.B., Phillips, S.C, Collett, T., Cook, A., Boswell, R., and the UT-GOM2-1 Expedition Scientists, 2018. UT-GOM2-1 Hydrate Pressure Coring Expedition Summary. In Flemings, P.B., Phillips, S.C, Collett, T., Cook, A., Boswell, R., and the UT-GOM2-1 Expedition Scientists, Proceedings of the UT-GOM2-1 Hydrate Pressure Coring Expedition, Austin, TX (University of Texas Institute for Geophysics, TX). https://dx.doi.org/10.2172/1647223.

Flemings, P.B., Phillips, S.C, Collett, T., Cook, A., Boswell, R., and the UT-GOM2-1 Expedition Scientists, 2018. UT-GOM2-1 Hydrate Pressure Coring Expedition Methods. In Flemings, P.B., Phillips, S.C, Collett, T., Cook, A., Boswell, R., and the UT-GOM2-1 Expedition Scientists, Proceedings of the UT-GOM2-1 Hydrate Pressure Coring Expedition: Austin, TX (University of Texas Institute for Geophysics, TX). https://dx.doi.org/10.2172/1647226

Flemings, P.B., Phillips, S.C, Collett, T., Cook, A., Boswell, R., and the UT-GOM2-1 Expedition Scientists, 2018. UT-GOM2-1 Hydrate Pressure Coring Expedition Hole GC 955 H002. In Flemings, P.B., Phillips, S.C, Collett, T., Cook, A., Boswell, R., and the UT-GOM2-1 Expedition Scientists, Proceedings of the UT-GOM2-1 Hydrate Pressure Coring Expedition: Austin, TX (University of Texas Institute for Geophysics, TX). https://dx.doi.org/10.2172/1648313

Flemings, P.B., Phillips, S.C, Collett, T., Cook, A., Boswell, R., and the UT-GOM2-1 Expedition Scientists, 2018. UT-GOM2-1 Hydrate Pressure Coring Expedition Hole GC 955 H005. In Flemings, P.B., Phillips, S.C, Collett, T., Cook, A., Boswell, R., and the UT-GOM2-1 Expedition Scientists, Proceedings of the UT-GOM2-1 Hydrate

Pressure Coring Expedition: Austin, TX (University of Texas Institute for Geophysics, TX). https://dx.doi.org/10.2172/1648318

2.3.4 Data Reports

Fortin, W.F.J., Goldberg, D.S., Küçük, H.M., 2020, Data Report: Prestack Waveform Inversion at GC 955: Trials and sensitivity of PWI to high-resolution seismic data, In Flemings, P.B., Phillips, S.C, Collett, T., Cook, A., Boswell, R., and the UT-GOM2-1 Expedition Scientists, Proceedings of the UT-GOM2-1 Hydrate Pressure Coring Expedition: Austin, TX (University of Texas Institute for Geophysics, TX). http://dx.doi.org/10.2172/1647733, 7 p.

Heber, R., Cook, A., Sheets, J., Sawyer, 2020. Data Report: High-Resolution Microscopy Images of Sediments from Green Canyon Block 955, Gulf of Mexico. In Flemings, P.B., Phillips, S.C, Collett, T., Cook, A., Boswell, R., and the UT-GOM2-1 Expedition Scientists, Proceedings of the UT-GOM2-1 Hydrate Pressure Coring Expedition: Austin, TX (University of Texas Institute for Geophysics, TX). https://dx.doi.org/10.2172/1648312, 6 p.

Heber, R., Cook, A., Sheets, J., and Sawyer, D., 2020. Data Report: X-Ray Diffraction of Sediments from Green Canyon Block 955, Gulf of Mexico. In Flemings, P.B., Phillips, S.C, Collett, T., Cook, A., Boswell, R., and the UT-GOM2-1 Expedition Scientists, Proceedings of the UT-GOM2-1 Hydrate Pressure Coring Expedition: Austin, TX (University of Texas Institute for Geophysics, TX). https://dx.doi.org/10.2172/1648308, 27 p.

Johnson, J.E., MacLeod, D.R., Divins, D.L., 2020. Data Report: UT-GOM2-1 Sediment Grain Size Measurements at Site GC 955, Holes H002 and H005. In Flemings, P.B., Phillips, S.C, Collett, T., Cook, A., Boswell, R., and the UT-GOM2-1 Expedition Scientists, Proceedings of the UT-GOM2-1 Hydrate Pressure Coring Expedition: Austin, TX (University of Texas Institute for Geophysics, TX). http://dx.doi.org/10.2172/1823030, 87 p.

Johnson, J.E., Divins, D.L., 2020, Data Report: UT-GOM2-1 Lithostratigraphic Core Description Logs at Site GC 955, Holes H002 and H005. In Flemings, P.B., Phillips, S.C, Collett, T., Cook, A., Boswell, R., and the UT-GOM2-1 Expedition Scientists, Proceedings of the UT-GOM2-1 Hydrate Pressure Coring Expedition: Austin, TX (University of Texas Institute for Geophysics, TX)., http://dx.doi.org/10.2172/1823034, 30 p.

Phillips, I.M., 2018. Data Report: X-Ray Powder Diffraction. In Flemings, P.B., Phillips, S.C, Collett, T., Cook, A., Boswell, R., and the UT-GOM2-1 Expedition Scientists, Proceedings of the UT-GOM2-1 Hydrate Pressure Coring Expedition: Austin, TX (University of Texas Institute for Geophysics, TX). https://dx.doi.org/10.2172/1648320 14 p.

Purkey Phillips, M., 2020, Data Report: UT-GOM2-1 Biostratigraphy Report Green Canyon Block 955, Gulf of Mexico. In Proceedings of the UT-GOM2-1 Hydrate Pressure Coring Expedition: Austin, TX (University of Texas Institute for Geophysics, TX)., http://dx.doi.org/10.2172/1823039, 15 p.

Solomon, E.A., Phillips, S.C., 2021, Data Report: Pore Water Geochemistry at Green Canyon 955, deepwater Gulf of Mexico, In Flemings, P.B., Phillips, S.C, Collett, T., Cook, A., Boswell, R., and the UT-GOM2-1 Expedition Scientists, UT-GOM2-1 Hydrate Pressure Coring Expedition Report: Austin, TX (University of Texas Institute for Geophysics, TX), http://dx.doi.org/ 10.2172/1838142, 14 p

2.4 Processing of the UT-GOM2-2 Hydrate Coring Expedition

Volume contents will be published on the UT-GOM2-2 Expedition Proceedings website and on OSTI.gov.

2.4.1 Prospectus

Peter Flemings, Carla Thomas, Tim Collett, Fredrick Colwell, Ann Cook, John Germaine, Melanie Holland, Jesse Houghton, Joel Johnson, Alberto Malinverno, Kevin Meazell, Tom Pettigrew, Steve Phillips, Alexey Portnov, Aaron Price, Manasij Santra, Peter Schultheiss, Evan Solomon, Kehua You, UT-GOM2-2 Prospectus: Science and Sample Distribution Plan, Austin, TX (University of Texas Institute for Geophysics, TX). http://dx.doi.org/10.2172/1827729, 141 p.

2.5 Websites

- Project Website:

https://ig.utexas.edu/energy/genesis-of-methane-hydrate-in-coarse-grained-systems/

- UT-GOM2-2 Expedition Website

https://ig.utexas.edu/energy/gom2-methane-hydrates-at-the-university-of-texas/gom2-2-expedition/

- UT-GOM2-1 Expedition Website:

https://ig.utexas.edu/energy/genesis-of-methane-hydrate-in-coarse-grained-systems/expedition-ut-gom2-1/

- Project SharePoint:

https://sps.austin.utexas.edu/sites/GEOMech/doehd/teams/

- Methane Hydrate: Fire, Ice, and Huge Quantities of Potential Energy:

https://www.youtube.com/watch?v=f1G302BBX9w

- Fueling the Future: The Search for Methane Hydrate:

https://www.youtube.com/watch?v=z1dFc-fdah4

- Pressure Coring Tool Development Video:

https://www.youtube.com/watch?v=DXseEbKp5Ak&t=154s

2.6 Technologies Or Techniques

UT completed testing and final development of the Probe Deployment Tool (PDT). The PDT is used for deploying scientific instruments for sampling subsea formations (e.g. the T2P) through a drill string via wireline, while simultaneously reducing/eliminating heave affects. The PDT will be used to deploy the T2P during the UT-GOM2-2 drilling program.

Previous bench tests of the PDT indicated that the sliding collet was occasionally reengaging the Running Pulling Tool (RPT), negating the ability of the RPT to engage the PDT inner rod subassembly during recovery of the PDT. A sliding collet “hold down” spring was added to the PDT latch to prevent the sliding collet from moving downward and reengaging the RPT during recovery of the PDT (Figure 2-1).

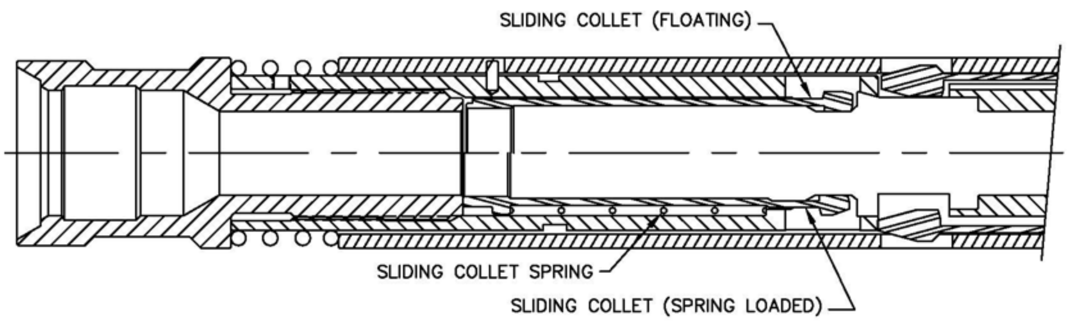

Figure 2-1: Schematic of Probe Deployment Tool latch assembly.

On February 14, UT and Pettigrew Engineering conducted a full-function vertically-oriented bench test of the Probe Deployment Tool (PDT) at Geotek’s high-pressure downhole test facility in Salt Lake City, Utah (Figure 2-2). Multiple successful full-function tests of the modified PDT latch assembly were performed in the downhole test chamber. The test demonstrated that the sliding collet is no longer reengaging the RPT during recovery of the PDT, and that the final engineering modifications made to the PDT were successful.

Testing and development of the PDT are now complete. The PDT is now field-ready and will be used to deploy the T2P as part of the UT-GOM2-2 field science program. UT and Geotek are also exploring the possibility of using the PDT as a combined ‘Run-in’ and ‘Pulling’ tool for use in deployment of the Pressure Coring Tool with Ball (PCTB). Currently, PCTB deployment requires a separate ‘run-in’ and ‘pulling’ tool. If the PDT running/pulling tool could be used for this, then there would be significant time saved during drilling because the tool that deploys the PCTB would only need to be deployed once (not twice) on the wireline.

Figure 2-2: Probe Deployment Tool full-function bench testing at Geotek Coring, Inc. test facility in Salt Lake City, Utah.

2.7 Inventions, Patent Applications, and/or Licenses

Nothing to report.

3 CHANGES/PROBLEMS

3.1 Changes In Approach And Reasons For Change

UT has transitioned UT-GOM2-2 preparation and planning efforts towards performing the expedition in 2023, with the expectation that the expedition will be sufficiently funded by this time. See Section 3.2 and 3.3 for further discussion.

3.2 Actual Or Anticipated Problems Or Delays And Actions Or Plans To Resolve Them

In December, 2021, UT and US DOE determined that performing UT-GOM2-2 in 2022 was no longer viable, and made the decision to pursue a 2023 field program. This decision was based on the following facts:

1. On September 30, 2021, the U.S. Federal Government passed a continuing resolution for FY 2022 appropriations through December 3, 2021 (H.R. 5305). The continuing resolution was extended through February 18, 2021 (H.R. 6119), then through March 11 (H.R. 6117). As a result, the FY2022 project budget for the GOM2 project was unknown until mid-March.
2. In UT's contract negotiations with Helix Well Ops., the opportunity for a 2022 field program required a commencement date of May 1, 2022. If UT terminated or rescheduled the field program within 90 days of the May 1, 2022 start date (January 31, 2022) UT would incur a minimum penalty of $2.03M.

Because UT had a deadline of January 31 for full financial commitment to Helix Well Ops., but the budget for FY 2022 was unknown until March, there was no path forward to pursuing UT-GOM2-2 in 2022. UT and DOE agreed to defer the field program to 2023.

3.3 Changes That Have A Significant Impact On Expenditures

The decision to defer UT-GOM2-2 from 2022 to 2023 will have a significant impact on project costs. UT is continuing to evaluate the scale of these impacts.

We anticipate numerous financial impacts to the current budget and spending projections:

- The contractual vessel costs (Helix Well Ops.) are greater in 2023 than in 2022.
- Current trends in the offshore drilling market indicate that rates are increasing.
- Fuel prices are increasing which will impact costs of operating the Helix vessel, offshore contractors (e.g. supply boats, helicopters), shipping and trucking.
- Some large contractual expenditures planned for 2021-2022 must be shifted to 2022-2023.
- We anticipate that delaying UT-GOM2-2 will require expanding the GOM2 program by one year.

3.4 Change Of Primary Performance Site Location From That Originally Proposed

None.

4 SPECIAL REPORTING REQUIREMENTS

4.1 Current Project Period

Task 1.0 – Revised Project Management Plan

Subtask 15.5 – Final UT-GOM2-2 Scientific Drilling Program Operations Plan

4.2 Future Project Periods

Task 1.0 – Revised Project Management Plan

Subtask 17.1 – Project Sample and Data Distribution Plan

Subtask 17.3 – UT-GOM2-2 Scientific Drilling Program Scientific Results Volume

5 BUDGETARY INFORMATION

The Budget Period 5 cost summary is provided in Table 5-1.

Table 5-1: Phase 5 / Budget Period 5 Cost Profile

Baseline Reporting Quarter	Budget Period 5							
	Y1Q1		Y1Q2		Y1Q3		Y1Q4	
	10/01/20-12/31/20		01/01/21-03/31/21		04/01/21-06/30/21		07/01/21-09/30/21	
	Y1Q1	Cumulative Total	Y1Q2	Cumulative Total	Y1Q3	Cumulative Total	Y1Q4	Cumulative Total
Baseline Cost Plan								
Federal Share	$ 587,651	$ 31,973,595	$ 581,151	$ 32,554,746	$ 5,466,306	$ 38,021,052	$ 581,151	$ 38,602,203
Non-Federal Share	$ 150,293	$ 23,871,255	$ 148,630	$ 24,019,885	$ 1,398,018	$ 25,417,903	$ 148,630	$ 25,566,533
Total Planned	$ 737,944	$ 55,844,850	$ 729,781	$ 56,574,631	$ 6,864,324	$ 63,438,955	$ 729,781	$ 64,168,736
Actual Incurred Cost								
Federal Share	$ 589,548	$ 29,766,294	$ 426,667	$ 30,192,961	$ 2,072,269	$ 32,265,230	$ 598,900	$ 32,864,131
Non-Federal Share	$ 220,056	$ 23,547,000	$ 374,124	$ 23,921,124	$ 623,736	$ 24,544,860	$ 222,682	$ 24,767,542
Total Incurred Cost	$ 809,604	$ 53,313,294	$ 800,791	$ 54,114,085	$ 2,696,006	$ 56,810,091	$ 821,582	$ 57,631,673
Variance								
Federal Share	$ 1,897	$ (2,207,301)	$ (154,484)	$ (2,361,785)	$ (3,394,037)	$ (5,755,822)	$ 17,750	$ (5,738,072)
Non-Federal Share	$ 69,763	$ (324,255)	$ 225,493	$ (98,761)	$ (774,281)	$ (873,043)	$ 74,052	$ (798,991)
Total Variance	$ 71,661	$ (2,531,556)	$ 71,010	$ (2,460,546)	$ (4,168,318)	$ (6,628,864)	$ 91,801	$ (6,537,063)
Baseline Reporting Quarter	**Budget Period 5**							
	Y2Q1		**Y2Q2**		**Y2Q3**		**Y2Q4**	
	10/01/21-12/31/21		**01/01/22-03/31/22**		**04/01/22-06/30/22**		**07/01/22-09/30/22**	
	Y2Q1	**Cumulative Total**	**Y2Q2**	**Cumulative Total**	**Y2Q3**	**Cumulative Total**	**Y2Q4**	**Cumulative Total**
Baseline Cost Plan								
Federal Share	$ 4,433,883	$ 43,036,085	$ 749,973	$ 43,786,058	$ 20,274,089	$ 64,060,147	$ 710,837	$ 64,770,984
Non-Federal Share	$ 700,232	$ 26,266,765	$ 118,441	$ 26,385,206	$ 3,201,835	$ 29,587,040	$ 112,261	$ 29,699,301
Total Planned	$ 5,134,114	$ 69,302,850	$ 868,414	$ 70,171,264	$ 23,475,924	$ 93,647,188	$ 823,097	$ 94,470,285
Actual Incurred Cost								
Federal Share	$ 466,675	$ 33,330,806	$ 607,849	$ 33,938,654				
Non-Federal Share	$ 254,642	$ 25,022,184	$ 281,474	$ 25,303,658				
Total Incurred Cost	$ 721,317	$ 58,352,990	$ 889,323	$ 59,242,313				
Variance								
Federal Share	$ (3,967,208)	$ (9,705,280)	$ (142,124)	$ (9,847,404)				
Non-Federal Share	$ (445,590)	$ (1,244,581)	$ 163,033	$ (1,081,548)				
Total Variance	$ (4,412,798)	$ (10,949,860)	$ 20,909	$ (10,928,952)				

6 BIBLIOGRAPHY

Flemings, P. B., 2021a, Y7Q1 Quarterly Research Performance Progress Report (Period ending 12/31/2020), Deepwater Methane Hydrate Characterization and Scientific Assessment, DOE Award No.: DE-FE0023919.

-, 2021b, Y7Q2 Quarterly Research Performance Progress Report (Period ending 3/31/2021), Deepwater Methane Hydrate Characterization and Scientific Assessment, DOE Award No.: DE-FE0023919.

Malinverno, A., Kastner, M., Torres, M. E., and Wortmann, U. G., 2008, Gas hydrate occurrence from pore water chlorinity and downhole logs in a transect across the northern Cascadia margin (Integrated Ocean Drilling Program Expedition 311): Journal of Geophysical Research: Solid Earth, v. 113, no. B8, p. B08103. https://doi.org/10.1029/2008jb005702

You, K., Summa, L., Flemings, P., Santra, M., and Fang, Y., 2021, Three-Dimensional Free Gas Flow Focuses Basin-Wide Microbial Methane to Concentrated Methane Hydrate Reservoirs in Geological System: Journal of Geophysical Research: Solid Earth, v. 126, no. 12, p. e2021JB022793. https://doi.org/https://doi.org/10.1029/2021JB022793

7 ACRONYMS

Table 7-1: List of Acronyms

ACRONYM	DEFINITION
AAPG	American Association of Petroleum Geologists
BOEM	Bureau of Ocean Energy Management
BSEE	Bureau of Safety and Environmental Enforcement
CPP	Complimentary Project Proposal
DOE	U.S. Department of Energy
DOC	Dissolved Organic Carbon
GC	Green Canyon
IODP	International Ocean Discovery Program
LWD	Logging While Drilling
MAD	Moisture and Density
MAPE	Mean Absolute Percentage Error
NEPA	National Environmental Policy Act
NETL	National Energy Technology Laboratory
NMR	Nuclear Magnetic Resonance
OCS	Outer Continental Shelf
OSTI	Office of Scientific and Technical Information
PCATS	Pressure Core Analysis and Transfer System
PCC	Pressure Core Center
PCTB	Pressure Core Tool with Ball Valve
PI	Principle Investigator
PM	Project Manager
PMP	Project Management Plan
PMRS	Pressure Maintenance and Relief System
QRPPR	Quarterly Research Performance and Progress Report
RBBC	Resedimented Boston Blue Clay
RPPR	Research Performance and Progress Report
RUE	Right-of-Use-and-Easement
SEG	Society of Exploration Geophysicists
SOPO	Statement of Project Objectives
UNH	University of New Hampshire
USCG	United States Coast Guard
UT	University of Texas at Austin
UW	University of Washington
WR	Walker Ridge
XCT	X-ray Computed Tomography

National Energy Technology Laboratory

626 Cochrans Mill Road
P.O. Box 10940
Pittsburgh, PA 15236-0940

3610 Collins Ferry Road
P.O. Box 880
Morgantown, WV 26507-0880

13131 Dairy Ashford Road, Suite 225
Sugar Land, TX 77478

1450 Queen Avenue SW
Albany, OR 97321-2198

Arctic Energy Office
420 L Street, Suite 305
Anchorage, AK 99501

Visit the NETL website at:
www.netl.doe.gov

Customer Service Line:
1-800-553-7681

NATIONAL ENERGY TECHNOLOGY LABORATORY

U.S. DEPARTMENT OF ENERGY | NATIONAL ENERGY TECHNOLOGY LABORATORY